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THE LONDON NATURALIST

Journal of the
LONDON NATURAL HISTORY SOCIETY

No. 73 1994

LONDON NATURAL HISTORY SOCIETY

The Society welcomes new members, both beginners and experts. Its Area lies within a 20-mile (32-km) radius of St Paul's Cathedral and here most of its activities take place. Although much covered with bricks and mortar, it is an exciting region with an astonishing variety of flora and fauna. The Society comprises Sections whose meetings are open to all members without formality. For those interested in arachnology, archaeology, botany, conchology, conservation, ecology, entomology, geology, herpetology, mammalogy, ornithology, palaeontology or rambling, there is a Section ready to help.

Publications

The London Naturalist, published annually, contains papers on the natural history and archaeology of the London Area, including records of plants and animals.

The *London Bird Report*, also published annually, contains the bird records for the London Area for each year, as well as papers on various aspects of ornithology.

Bulletins of news items, including the Society's *Newsletter*, *The London Atalanta* and the *Ornithological Bulletin*, are sent to members throughout the year.

Indoor meetings

These are held in most weeks throughout the year, with lectures, discussions, colour slides and films on all aspects of natural history.

Field meetings

Led by experts to visit interesting natural history localities, both within and outside our Area. These excursions are very popular with beginners wishing to increase their knowledge and enable members to get to know one another.

Library

A large selection of books and journals on most aspects of natural history is available for loan or consultation by members free of charge.

Reading circles

Many important natural history journals are circulated by the Sections at a fraction of the cost of subscribing direct.

SUBSCRIPTIONS

| | |
|---------------------------------|--------|
| ORDINARY MEMBERS | £10.00 |
| JUNIOR MEMBERS | £5.00 |
| SENIOR MEMBERS | £5.00 |
| FAMILY MEMBERS | £2.00 |
| CORPORATE SUBSCRIBERS | £10.00 |

Junior membership is for persons under 18, or under 25 and receiving full-time education, and senior membership is for persons over 65 who have been continuous members of the Society for ten complete years. All except family members receive one free copy of *The London Naturalist* and the *London Bird Report* each year. Cheques and postal orders, payable to the London Natural History Society, should be sent to:

The Membership Secretary, LNHS, P. C. Holland,
Flat 9, Pinewood Court, 23 Clarence Avenue,
London, SW4 8LB

THE LONDON NATURALIST

Back numbers of *The London Naturalist* and the *London Bird Report*, may be obtained from the Publications Sales Secretary, Mrs V. M. Friedman, 5 Temple Close, Cassiobury, Watford, Hertfordshire WD1 3DR. Reprints of the *Annual rainfall overlay*, *Master grid overlay*, *Habitat overlay*, *Regolith overlay*, *Air pollution overlay* and *Recording areas overlay* are free on receipt of a stamped addressed envelope.



Top. The daisy field, Nonsuch Park, Ewell, Surrey, July 1991.

Bottom. Looking south-west, Warren Farm, Ewell, Surrey, 1991.

THE LONDON NATURALIST

**Journal of the
LONDON NATURAL HISTORY SOCIETY**

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LONDON NATURAL HISTORY SOCIETY

Founded 1858

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Honorary Vice-Presidents

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Editor, *London Bird Report*: M. A. Hardwick, The Garden Flat, 13 Southcote Road, London N19 5BJ.

Editor, *Newsletter*: M. Thain, Upper Cairnryan, Harrow Park, Harrow, Middlesex HA1 3JE.

Elected Members of Council: J. F. P. Bennett, Dr C. Bowlt, M. J. Earp, Mrs R. Robbins, J. M. W. Topp, M. Trier.

Representative Members of Council: Botany – Dr M. C. Sheahan, Ecology and Entomology – J. A. Thompson, Geology – R. V. Goulding, Ornithology – Miss H. Baker, Ramblers and Archaeology – Miss D. E. Woods, South-West Middlesex – M. Radford.

The Society's recorders

Botany

Flowering plants and vascular cryptogams:

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Hertfordshire EN4 8TL

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c/o Department of Zoology,
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Dragonflies:

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35 Salisbury Avenue,
St Albans,
Hertfordshire AL1 4UB 0727 863532

Fishes:

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14 Theydon Park Road,
Theydon Bois, Epping,
Essex CM16 7LP

Butterflies, moths, invertebrates not listed elsewhere:

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Bishop's Stortford,
Hertfordshire CM23 3QP
0279 507697

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80 Weston Park,
London N8 9TB
081-341 2158

Orthoptera:

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Hornchurch,
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Heteroptera:

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Northolt, Middlesex UB5 4RL

Records may be sent to the appropriate recorder or to Colin Plant who will distribute to each recorder the relevant data from a mixed set of records.

Requests for information should be made to the appropriate recorder.

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Report of the Society for 1993

Presented at the Annual General Meeting on 7 December 1993

It is with deep regret that we record the deaths of Dr Bruce Campbell, an honorary vice-president of the Society, E. D. Bennett, Miss E. L. Chirgwin, R. Hastings, H. J. A. Kinsman and Mrs E. D. Parrinder, a member since 1938.

Council has been pleased to appoint Ray Softly as an honorary vice-president. He has been working hard for the Society for more years than most people like to remember: we are very much indebted to him. A sustained publicity campaign in late 1992 led to a growth in membership which now stands at 1,221. There is no reason why we could not easily accommodate twice that figure, and Council urges all members to seek to introduce to the Society friends and acquaintances who might benefit from membership and who might well have something to offer the natural history movement in London. The administration of the Society is soundly based — many projects are being undertaken, but extra workers in different disciplines are required.

The Society constantly seeks to publicize itself and it again took a table at the Annual Exhibition of the Amateur Entomologists' Society. It has also sought to strengthen its links with the surrounding county trusts, the London Ecology Unit and English Nature. We assisted the London Wildlife Trust in the preparation of their submission on Oxleas Wood. Members will recall the depth of feeling aroused by the proposal to site a road through such a sensitive area — the result of the enquiry delighted us all. The Society also provided a detailed response to the London Planning Advisory Committee who sent their consultation 'Draft 1993 Advice on Strategic Planning Guidance for London'. Many members helped our conservation officer David Bevan and our president Ruth Day to co-ordinate our reply — we are grateful to all of them.

July 1993 saw the publication of the Society's fifth book, *Larger moths of the London Area*, by Colin Plant. Our congratulations and thanks go to Colin for a job well done — the handsome case-bound book will look well on any shelf and will be of great value to all students of natural history in the future. The Council of the Society wishes to record its thanks to Mike Earp who prepared final camera-ready copy of both text and distribution maps originated by the author. Without Mike's expertise the book could not have been published at the price finally charged. It is hoped that 1994 will see the issuance of the *Geology drift map* — work has continued on the *New atlas of breeding birds*, but no publication date has yet been fixed.

The Sections have had a busy year although both Geology and Ramblers have suffered as a result of the illness of key officers. We hope that both Richard Goulding and Doreen Woods will soon be restored to health. It is intended from this year to revert to the practice of having separate reports for each section published in the appropriate *London Naturalist*. Field meetings continue to be well attended, but it appears difficult to attract members to indoor meetings no matter how good the lecturer.

Notwithstanding this, many members did enjoy the talk given by Dr Ignatieva, a botanist from St Petersburg; the Society was pleased to be able to help Dr Ignatieva with her travelling costs. The changed circumstances in Europe allow many eminent scientists new opportunities to travel. Your Society will be looking to see whether some of these visits can result in new and varied subjects for lectures to members. The same philosophy has allowed us to make a minor, but useful, contribution to the proposed *Flora of Budapest* on which Hungarian scientists are now working.

In 1993 the Society has been active in the awarding of research grants, the most important of which was £1,000 to Surrey Wildlife Trust to assist with their Biological Data Recording Programme. Other grants have gone to Nonsuch Watch, the Barnet Wildlife Group, the Hampstead Heath Group and to Clive Herbert for his work on the Muntjac Survey. In early 1993 the Society was instrumental in setting up a 'Regionally Important Geological/Geomorphological Sites' committee for London and we are

grateful to Richard Butler for agreeing to act as our representative.

The work of the Society at Bookham continues and work has started in conjunction with The National Trust on providing proper toilet facilities — the Society will be making a significant contribution to the funding for this work.

The Society is concerned that scientific information should be as widely disseminated as possible. It is a source of some satisfaction that our journals are found in American, Canadian and New Zealand universities and study centres. Nearer to home sales of all our publications have been steady. During 1994 it is planned to make up runs of journals for sale. A list of journal back numbers will be published so that members may fill gaps in their collections.

Work on the Society's library has continued — we are grateful to Imperial College for the help which they give us. It would not be appropriate to complete this section of the report without expressing our thanks to Joan Hardy who is returning to the north of England. For over twenty-five years Joan has been working on our library. We owe her an enormous debt and wish her well in her native surroundings.

Finally to our officers, secretaries, recorders — to all those who 'do', our grateful thanks — without these hard-working volunteers the Society could not function. All members are indebted to them.

Treasurer's notes on the annual accounts for 1992–1993

Presented at the Annual General Meeting on 7 December 1993

In the financial year ended 30 June 1993 the Society's accounts show a small deficit of £427 (after making provision for the diminution in value of investments where the current market value is less than the book value), compared with a surplus of £16,172 in 1991–2.

Total income was £31,282, compared with £45,286 in 1991–2. In that year, the Society received £7,017 (net) from two generous bequests, and sales of investments showed a profit of £6,514 over their book value. This year there has been no income from bequests, nor have any sales been made from our portfolio of investments. Other income from investments fell by 5 per cent to £17,805 (net of charges). Although subscription rates were unchanged, income from subscriptions rose by 14 per cent to £10,348. Sales of Society publications remained at a healthy level, but the sale of books at reduced prices meant that gross receipts were offset by significantly higher expenses on postage and packing. Overall, net receipts from publications sales fell by 28 per cent from £2,732 in 1991–2 to £1,962.

Coupled with the fall in income, total expenditure rose by 43 per cent from £25,288 in 1991–2 to £36,003. Increased expenditure was incurred under virtually all headings, with significant rises attributable to the purchase of computer software for biological recording, publicity and grants. The cost of producing and mailing the Society's regular publications was 28 per cent higher than in 1991–2, at £21,289.

Society grants

The Society sets aside a small amount each year to assist conservation work, the establishment or maintenance of nature reserves and scientific investigation in the London Area. Applications for grants and loans are considered by the Administration and Finance Committee: enquiries should be addressed to its secretary. Papers reporting results of research supported in this way must be submitted for publication in the Society's journals.

Statement of trustees' responsibilities

Charity law requires the trustees to prepare financial statements for each financial year which give a true and fair view of the state of affairs of the charity and of its financial activities for that period. In preparing those financial statements the trustees are required to:

- select suitable accounting policies and then apply them consistently;
- make judgements and estimates that are reasonable and prudent;
- state whether applicable accounting standards have been followed subject to any material departures disclosed and explained in the financial statements; and
- prepare the financial statements on the going concern basis unless it is inappropriate to presume that the charity will continue in business.

The trustees are responsible for keeping proper accounting records which disclose with reasonable accuracy at any time the financial position of the charity and to enable them to ensure that the financial statements comply with the Charities Act 1992. They are also responsible for safeguarding the assets of the charity and for taking reasonable steps for the prevention and detection of fraud or other irregularities.

Report of the auditors to the members of the London Natural History Society

We have audited the financial statements on pages 10 to 11 which have been prepared under the accounting policies set out on page 11.

Respective responsibilities of trustees and auditors

As stated in the Annual Report, the Society's Council as trustees are responsible for the preparation of financial statements. It is our responsibility to form an independent opinion, based on our audit, on those statements and to report our opinion to you.

Basis of opinion

We conducted our audit in accordance with Auditing Standards issued by the Auditing Practices Board. An audit includes examination, on a test basis, of evidence relevant to the amounts and disclosures in the financial statements. It also includes an assessment of the significant estimates and judgements made by the trustees in the preparation of the financial statements, and whether the accounting policies are appropriate to the Society's circumstances, consistently applied and adequately disclosed.

We planned and performed our audit so as to obtain all the information and explanations which we considered necessary in order to provide us with sufficient evidence to give reasonable assurance that the financial statements are free from material misstatement, whether caused by fraud or other irregularity or error. In forming our opinion we also evaluated the overall adequacy of the presentation of information in the financial statements.

Unqualified opinion

In our opinion the financial statements give a true and fair view of the state of the Society's affairs as at 30 June 1993 and of its results for the year then ended.

Note to the accounts

Accounting policies

- a) Subscriptions, which are collected on a calendar basis, continue to be brought in as received. No account is taken of subscriptions in arrears until received.
- b) Investment Income is credited to the Income and Expenditure account together with the income tax credit receivable.
- c) Provision is made for all material debtors, prepayments, creditors and accruals with the exception of subscription income (see note a above).
- d) Depreciation is provided on fixed assets at rates calculated to write off the cost of each asset over its expected useful life as follows:—

| | |
|--------------------|-------|
| Computer equipment | – 25% |
| Other equipment | – 20% |
- e) The London Natural History Society is registered as a charity (Charity Commission Reference 2062228) and as such tax exemptions apply to the income arising from and expended on its charitable activities.

| 1992 | 1993 |
|---|---|
| £ | £ |
| <p><i>Fixed Assets acquired after 30 June 1985, excluding library books:</i></p> <p>Computers, including ancillary equipment and initial programming costs</p> <p>Library equipment</p> <p>Other indoor equipment</p> <p>Bat detectors</p> <p>Bookham hut</p> <p>Less: Depreciation</p> <p><i>Quoted investments at cost</i></p> <p>Less: Provision</p> <p>(Market value £394,980 — 1992: £330,958)</p> <p><i>Current assets</i></p> <p>Funds at bank and on deposit:</p> <p>National Westminster Bank PLC</p> <p>Charities deposit fund</p> <p>Cash in hand</p> <p>Payments in advance and other debtors</p> <p>Tax recoverable on investment income</p> <p>Tax recoverable on bequest deposit</p> <p>Stationery stocks</p> <p>Less: <i>Current liabilities</i></p> <p>Custodian's charges</p> <p>Contributions to bat boxes</p> <p>General liabilities and accrued expenditure</p> <p>Total net assets</p> <p>Representing: <i>General Fund</i> (incorporating the Hindson and Castell Bequests)</p> <p>Balance at 30 June 1992</p> <p>Surplus/(Deficit) for the year</p> | <p>13,857</p> <p>143</p> <p>1,739</p> <p>413</p> <p>2,158</p> <p>18,310</p> <p>(15,652)</p> <p>2,658</p> <p>231,908</p> <p>(10,284)</p> <p>221,624</p> <p>12,754</p> <p>1,000</p> <p>13,754</p> <p>807</p> <p>271</p> <p>3,248</p> <p>—</p> <p>320</p> <p>(4,291)</p> <p>(25)</p> <p>(2,329)</p> <p>18,400</p> <p>(6,645)</p> <p>£236,037</p> <p>236,512</p> <p>(475)</p> <p>£236,037</p> |

Official and sectional reports for 1993

LIBRARY

During the year 77 items have been added to stock, to enable the library to continue its role as an essential information resource for members.

For several years, the Society has been allowed the use of the basement room 03 at Imperial College for storage and as a venue for administrative activities. As a result of recent discussions with Mrs Czigány, the College Librarian, steps have been taken to make the environment more agreeable for meetings. The opportunity has also been taken to transfer the library material previously stored in the College archive to a locked cupboard in room 03. The Society is also reducing the amount of space occupied in Imperial's stack by duplicate runs of periodicals.

Joan Hardy, who has been responsible, for many years, for a large share of the work involved in maintaining the LNHS Library, has decided to return to her native Sunderland. Her presence will be missed, and the Society is extremely grateful for all the hard work she has put in to keep things going. I am pleased to report that Joan is not abandoning the LNHS altogether, since she intends to continue creating the computerized catalogue of the bookstock which she set up two years ago. Linda Hewitt, a long-standing member of the Library Committee, has taken over Joan's work at the London end, and will be feeding bibliographic information to Joan as needed.

The Committee is also losing another long-standing member — Rodney Burton — who has decided to call it a day. Rodney's detailed knowledge of the botanical literature has often been called upon, and we hope he will continue to offer advice via the Botany Section Committee.

The Society wishes to record its thanks to Mrs Czigány (College Librarian), Mrs Yeadon (Life Sciences Librarian), and their staff for continuing to provide accommodation and other facilities.

J. W. BARRINGTON, *Librarian*

CONSERVATION

Twelve years have elapsed since the Society's long-standing Nature Conservation Committee was wound up following the formation of the London Wildlife Trust in 1981. During this time the Trust has worked tirelessly to defend London's 'green spaces' and has had many outstanding successes. Nevertheless, there has been no let-up in the continuing pressure on sites of nature conservation importance in the capital. It was in this knowledge that Council considered that it might be helpful to appoint an officer to act as a link between this Society and the major conservation organizations based in and around London. Accordingly, a conservation officer was appointed at the 1992 AGM.

The first year's activities have been largely concerned with developing and strengthening links with the surrounding wildlife trusts, English Nature and the London Ecology Unit. The Society contributed to the successful campaign to protect Oxleas Wood by providing historical data and other detailed ecological information. The conservation officer also submitted evidence for the defence of a number of less well publicized sites which were also threatened. These included South Norwood Country Park, East Ham Nature Reserve and Branch Hill in Hampstead (see Brian Wurzell's survey, p. 61).

A detailed response was submitted to the London Planning Advisory Committee (LPAC), who requested comment on their 'Draft 1993 Advice on Strategic Planning Guidance for London'. This important document sets out a strategic planning framework for London, covering the rest of the 1990s and the first decade of the new millennium. Of particular interest to the LNHS is a chapter on London's Environment. This includes comment on London's green framework, the Green Belt, Metropolitan

Open Land and other 'green issues'. There is advice on ecology and nature conservation and urban environmental quality. Hopefully the Society's views will be taken into account in the final document due out in 1994.

The Royal Parks Review Group held a conference in May 1993 to discuss their draft report on St James's and Green Parks and Regent's Park and Primrose Hill. This was attended by Helen Baker on behalf of the Society. Nature conservation appeared to be given a rather low priority, but it is hoped that the Society's comments will be fully considered in the final report to the Secretary of State for National Heritage, who has responsibility for the management of the Royal Parks. Dame Jennifer Jenkins, who chaired the Conference, subsequently spoke to the Society on 'The Future of the Royal Parks'.

The London Borough of Richmond-upon-Thames wrote to the Society requesting comment on a series of management briefs they had prepared for their major sites of nature conservation importance. These included Sheen Common, Palewell Common, Ham Common, Ham Lands, Barnes Common and Lonsdale Reservoir. Following widespread consultation with the Society's recorders and other interested members, the Conservation Officer collated a response which was sent to Richmond's Ecology Officer, Eve Risbridger. The management work is now being carried out by the British Trust for Conservation Volunteers, and Eve reports that our detailed response was very helpful in formulating the final management plans.

DAVID BEVAN, *Conservation Officer*

BOTANY SECTION

This was another active and interesting year for the Botany Section. There were three formal meetings: Dr Tim Rich spoke on the effects of climate change on the British flora, Dr Brian Ferry on the interesting flora of Dungeness, and at the AGM in November Dr Simon Owens of the Royal Botanic Gardens at Kew gave an illustrated talk on the complexity of the flower. In addition the Section organized a general meeting addressed by Alistair Culham on carnivorous plants. Informal meetings included the popular 'Best botanical slides of the year' evening, a meeting on the identification of hawkweeds, and another to which members brought any plant specimens which they had been baffled by, which were ably identified by Rodney Burton and David Bevan. These informal meetings are a very good way both to learn a lot from the experts in the Society, and to meet other like-minded members.

There were of course few field meetings in the winter months, apart from an interesting trip to the South London Botanical Institute in February. But we started off in April with a visit to Richmond Park, where we saw ivy-leaved crowfoot *Ranunculus hederaceus*. From May onwards there were frequent field trips, to: Fetcham Down; Harrow Weald Common and Bentley Priory where we saw the curious mousetail plant *Arisarum proboscoideum*, and of course 'Bevan's bittercress' *Cardamine* \times *fringsii*, also adder's tongue fern *Ophioglossum vulgatum* and three-veined sandwort *Moehringia trinervia*; Reigate Heath, with interesting heathland vegetation including upright chickweed *Moenchia erecta* and heath dog violet *Viola canina*; Brent Valley Park (a joint meeting with the BSBI) which will be remembered if only for the nightingale which sang for us; High Elms, Orpington; Windsor Great Park; Chertsey Meads; Dungeness (this meeting was arranged to follow shortly after Brian Ferry's talk); Lullingstone Park; Ham River Lands; the Grand Union Canal at West Drayton; east London canals; and a fungus foray with the London Wildlife Trust. The field programme was organized by our excellent new field meetings secretary, John Topp, who is also on the Field Meetings Committee of the BSBI — hence the joint meeting to Brent Valley Park. This kind of co-operation with other societies is very valuable.

Our chairman, Rodney Burton, has again had to act as indoor meetings secretary, as well as sharing his expertise in informal evening meetings and leading field meetings. Our thanks are also due to all who have addressed indoor meetings and led outdoor

trips, and to the members of the committee. We are very pleased to welcome two newcomers to the committee, Mr G. Hounscome and Miss B. Villiers, and we thank Bryan Radcliffe who is retiring from the committee after more than twenty years' continuous service.

RODNEY BURTON, *Chairman*, MARY CLARE SHEAHAN, *Secretary*

ECOLOGY and ENTOMOLOGY SECTION

The publication of the Society's fifth book, *Larger moths of the London Area*, by Colin Plant, has been a major event in a productive year. The Section has presented its usual varied programme of indoor and field meetings. We hosted the annual joint meeting with the British Entomological and Natural History Society in September. Five of the nine indoor meetings are summarized in *The London Atalanta*. This publication was started by the Section in 1987 with a modest print run of 120 per issue, but since June 1992 it has been circulated to all members of the Society, and this year it was accorded its ISSN by the British Library. All issues are held by the libraries of the Guildhall and the Natural History Museum, whilst it is scanned by BIOSIS UK for the *Zoological Record*. We held 25 field meetings during the year, of which 15 were at Bookham Common.

We thank our recorders, who work unobtrusively behind the scenes to add to our database of records for mammals, reptiles, amphibians, spiders, and six orders of insects. Edward Milner deserves special mention for his ongoing research into the spider fauna of London, resulting in regular contributions to the Society's *Newsletter* and *The London Naturalist*. His finds this year have included a species of Linyphiidae new to science. David Allen has continued to run with great efficiency the reading circles for both this Section and the Ornithology Section with a total of 13 titles.

RICHARD GOULDING, *Chairman*, C. B. ASHBY, *Secretary*

GEOLOGY SECTION

Field meetings

The Section conducted three field meetings in 1993, the first of which was on the 21 February to Highcliffe, Dorset. The Eocene deposits here are known as the Barton Beds. There have been considerable land slips and subsidence of the clay and Pleistocene deposits from the top of the cliffs. The pebble band which represents the ancient beach was noted. There were three marine transgressions during this period and these are represented in the horizons in the clay. The Solent covers the route of an ancient river which flowed from west to east. Glauconite is found in the clay which yielded *Turritella*, *Globularia*, *Cardita*, *Athleta*, *Stellaxis*, pecten shells, small fish teeth, sharks' teeth, turtle scutes, coral and lignite (fossil wood). These finds were specifically identified as follows:

Turritella sulcifera.

T. imbricataria

Globularia spp.

Athleta selseiensis.

Chelone (marine turtle).

Small fish teeth – various unidentified.

Stellaxis spp.

Cardita spp.

Chlamys trigintaradiatus (pecten)

Jaekelotodus trigonalis (shark)

A further Eocene site was visited on the 1 May at Bracklesham Bay, Sussex. Here the fossils lie beneath the tideline and may only be observed and collected when the tide is low. The finds from this location were:

Sharks' teeth – *Jaekelotodus trigonalis*

Fish vertebrae

Bivalves:

Nemocardium superbum
Chlamys trigintaradiatus
Venericor planicosta (very common)

Crassatella sowerbyi
Barbatia appendiculata
Panopea intermedia

Gastropods

Turritella sulcifera (common)
Scala acuta
Turritella conoidea var. *elongata* (common)

Bonellitia spp.
Sigmesalia fasciata

Others:

Dentalium spp.
Nummulites laevigatus (Foraminifera, very common)

A non-geological phenomenon which should be noted was that a large number of horseshoe or king crabs were washed up by the sea. A few of these were still alive.

The 24 July saw the Section at Osmington Mills, Dorset. Broken ammonite, belemnite and plesiosaur bones were found in the Jurassic Portland Limestone. A perfect brachiopod was also obtained. There was a gault infill on the cliff, and various Cretaceous fossils were discovered including *Gryphaea*, *Mytilus edulis*, fragmented bivalves and some oyster shells embedded in flint. A perfect pecten shell *Chlamys trigintaradiatus* was also found.

RICHARD GOULDING, *Chairman*, DAPHNE GOULDING, *Secretary*

ORNITHOLOGY SECTION

Most weekends the Ornithology Section has arranged a field meeting to an area of interest, enabling members to see many species and enabling less-experienced members to find help in identifying birds. There was also a meeting in Regent's Park to identify common birds and a session on photography for beginners. The indoor meetings covered individual species such as the dunnock and the snowy owl, or birds of other countries including Bulgaria, and Trinidad and Tobago. These were very popular with members.

On the research side, some members have taken part in the BTO pilot surveys for a new Breeding Bird Survey. Others have helped with the Gull Roost Survey and the Farmland Bunting Survey. A start has been made with inputting the data for the *Breeding bird atlas of the London Area*.

The Records Committee produced another excellent *London Bird Report* to a slightly revised format.

HELEN BAKER, *Chairman*, ANGELA LINNELL, *Secretary*

RAMBLERS and ARCHAEOLOGY SECTION

In the autumn of last year we were sorry to receive the resignation of Vic Mascull as our chairman after some nine years, prior to his moving to Somerset. However, shortly afterwards Richard Butler kindly offered to take over the post, and as he is an expert archaeologist and has had a close association with our Section in the past, this was very welcome. We have also welcomed a new Committee member, Jean Lord. In addition, Helen Hartley has agreed to act as representative on Council in lieu of Doreen Woods.

In order to stimulate more interest and acquire an even more varied programme, we have had joint meetings with BNA (both London and West Kent Branches), and this has proved very successful.

The average attendance for field meetings has risen slightly to 12 (22 on two occasions), and for indoor meetings to about 24. As we have outings of a general natural history nature, and combine them with items of local interest, our programme should appeal to most people, especially as we often enlist the services of experts outside the Society.

DOREEN E. WOODS, *Secretary*

SOUTH-WEST MIDDLESEX SECTION

During the year we held 17 field meetings with an average attendance of 12. Details of these meetings have appeared in the Society's *Newsletter*. We thank the leaders warmly for their services. We held seven indoor meetings during 1993, and the average attendance was 16. Our thanks are due to our programme secretary, Susanne Lee for all her work.

Our secretary, Mark Radford is resigning, but will continue to serve on the Committee and also as representative on Council. Ray Bowden has agreed to stand as chairman for a further year, but is hoping that someone else will be prepared to take over at next year's AGM.

R. G. BOWDEN, *Chairman*

The London Natural History Society

in its 1990s context

RUTH DAY

18 Zenoria Street, London SE22 8HP

Presidential Address delivered at the Annual General Meeting on 7 December 1993

Other presidents have, on these occasions, traced the long and distinguished history of our Society. That is not my intention this evening. Instead, I would like to describe it as it is now. I hope to set it in the context both of the times in which we live and of the activities of the nature conservation organizations working in our area. Our Society's history has made it what it is today. It is shaped by the interests and activities of its members and reshaped as one lot of members is gradually replaced by different people.

The Society changes almost imperceptibly. It is only when you read old *London Naturalists* that you realize how different it was in the past. It used to have a Chingford Branch, an Epping Forest Field Section, a Mammal Study Group and a Plant Galls Section. There used to be an active Junior Section. There was a Conservation Committee for many years, and, fairly briefly in the 1980s, a Records Committee. At one time, Archaeology, Ecology, and Entomology were all separate sections. *The London Naturalist* gave reports on the curation of the Society's collections. Nineteenth-century naturalists collected. Of course some people drew. There are some very beautiful natural history drawings; but for the most part, if you wanted a record of where you had been and what you had seen, you had to take a specimen. Photography hadn't got there yet. We have long ago given our collections to other people better able to look after them than we are today, and I mention all this only to show how our Society changes all the time, whether we realize it or not.

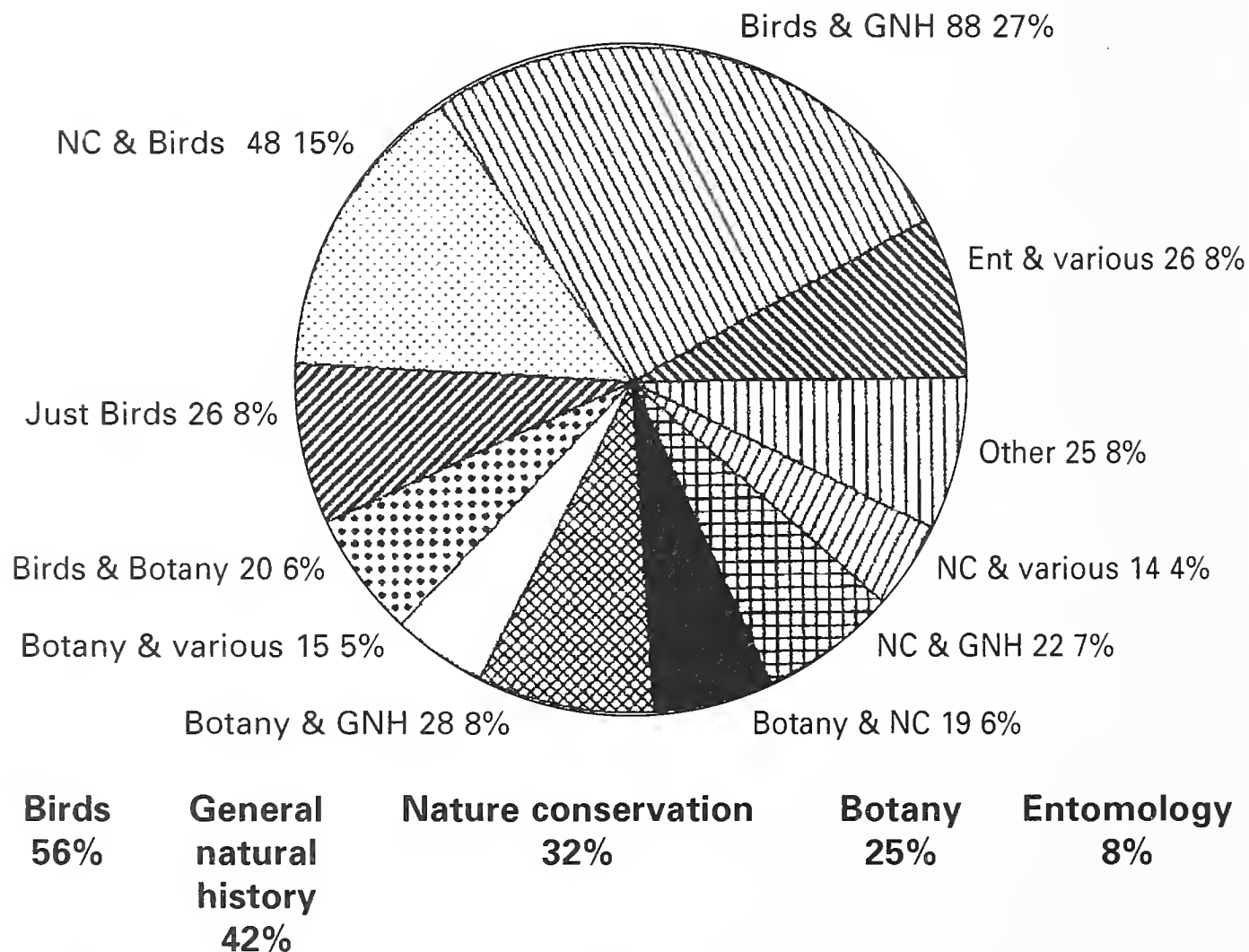
The Society is run by a **Council**, which meets five times a year, roughly every other month. Committees deal with specialist topics. Probably the most important of these is the **Administration and Finance Committee**, which also meets every other month, alternating with Council. This is the body which decides how the Society spends its money. If you look at the back of your *Programme*, you will see that we give grants for natural history research relevant to our area. The **Administration and Finance Committee** deals with grant applications and indeed decides whether we will commission research. The **Publications Working Group** co-ordinates the production of the books we publish. It was formed to deal with the *Larger moths of the London Area*, 1993, and is remaining as a standing committee to work on the new breeding bird atlas. Our journals and periodicals are outside its remit. The **London Naturalist Committee** was formed to advise the editor of *The London Naturalist*, but it is also a useful forum for deciding what material will appear in which of our publications, as the editors of the *Newsletter* and *The London Atalanta* are *ex officio* members of this committee. The Society has an excellent library which is shelved as a separate sequence at the Imperial College library, a very short walk from South Kensington Underground Station, where there is on-street parking after 6.30 p.m. and on Saturdays. Our library policy is to try and make sure we have local natural history books and pamphlets, especially those relevant to our recording area, and also to buy the really expensive natural history publications members need, which are probably too scientific for the average public lending library. The **Library Committee** determines library policy and has a budget from **Council** to buy new books, get journals bound and pay any other library bills. A lot of work is also done by individuals outside the committee. Members can visit the library and borrow books in the evenings and on Saturdays as well as in the daytime.

These committees are more or less direct extensions of **Council**. Then there are the **Sections**, who are the people who put the programme together. At the **Programme Committee** they meet the Programme Secretary and the *Programme* editor and fit

together the meetings they have been arranging over the previous six months. We have one regional section, **South-West Middlesex**, whose indoor meetings are held at Heston, where they have some absolutely superb talks. The others are grouped into subject areas: **Geology, Botany, Ornithology, Ecology and Entomology**, and **Ramblers and Archaeology**. The **Recorders** collect records for a particular taxonomic group. The **Ornithology Research Committee** decides what research projects the ornithologists are going to undertake. Usually these are linked to something that the British Trust for Ornithology is doing. Very often, however, they are given a local twist to make them more appropriate for our area. When, for example, the BTO announced a national survey in 1984 for wood warblers, redstarts and tree pipits, the LNHS decided to survey all woodlands in our area and record these three species quantitatively, and other breeding species except the most common ones on a presence or absence basis (Palmer 1987).

The **Bookham Common Survey** started in 1941 in the middle of the war, and has been going strong ever since. Bookham Common is an SSSI, within easy reach of London by train or car, has a number of uncommon species, including the purple emperor butterfly, and the great crested newt, and is a superb place to work if you want to do scientific research. I, myself, have been doing a census of the damselflies there since 1985. The hut has a library, microscopes and electric light and heating, so it is a very comfortable site-laboratory, even in the winter.

One of the first things I did as president was to send out a questionnaire, and I am very pleased that a quarter of the membership actually sent it back to me. The detailed results have already been published in the *Newsletter*, so I shall comment this evening on only two points: first, our members' interests. I was pretty draconian in restricting everyone to two main interests. Showing the replies on a pie chart indicates that many



n = 331, i.e. approx. 1/4 of membership.

FIG. 1. Main natural history interests from questionnaire of February 1993.

members have quite a wide range of interests. Fifty-six per cent of the people who replied certainly expressed an interest in birds, but three quarters of them were interested in other things as well. Twenty-five per cent of the respondents were interested in botany, but all of them had other interests, including six per cent who combined birds and botany. Both 'General natural history' (42 per cent) and 'Nature conservation' (32 per cent) were extremely well represented. The pie chart is shown in Figure 1.

My other comment is on our total membership figures. Our membership has remained pretty constant since the war at between 1,100 and 1,200. It appears to be going up at the moment, and I think perhaps we should try and put ourselves about a little more so that people become aware that we exist. I have a great regard for the county naturalists' trusts and in particular for the London Wildlife Trust, of which I am a member, but they do not duplicate what we do. They are different; and I think that a lot of people, who would really like to make a more serious study of natural history, are aware of them but not of us.

This brings me on fairly neatly to the subject of our neighbours. When the London Natural History Society started to record the wildlife within a 20-mile radius of St Paul's Cathedral in 1914 (which we call 'The London Area'), the present political boundaries did not exist, so the circular boundary you can see to Ken Osborne's excellent map in the *London Bird Report*, was a perfectly fair definition of 'London'. After the war, the county naturalists' trusts for the surrounding counties were founded:

| | |
|-------------------------|------|
| Berks., Bucks. and Oxon | 1961 |
| Essex | 1959 |
| Herts. & Middlesex | 1963 |
| Kent | 1958 |
| Surrey | 1959 |

and these naturally aimed to conserve nature within their county boundaries, so the first overlap occurred. Then in 1965, the old London County Council was subsumed under the Greater London Council, and the now familiar boundary round the 33 London boroughs came to mean 'London'. This boundary was adopted by two new organizations: the London Wildlife Trust (LWT) in 1981 and the GLC Ecology Section, now the London Ecology Unit (LEU), in 1982.

In 1982, the LWT ran a survey of foxes, called 'Foxwatch'. They encouraged everyone they could to ring them up with records of fox sightings, and in 1983, they reported the results in their members' paper *Wild London* (Roots 1983). It is interesting to compare their map with one Geoffrey Beven published in *The London Naturalist* on the distribution of grey squirrels 1953–6 (Beven 1957). Beven reported that there were no grey squirrels in the central parks or on Mitcham Common, although they occurred in Richmond Park, Bushy Park and Epping Forest. But what to me is rather shocking about that map is the vast area of white, which is 'unknown'. When you consider that a grey squirrel is a very visible, very noisy diurnal mammal that everybody can recognize and the LNHS had been working on this report for three years, I am stunned by the vast areas where nobody had taken the trouble to say 'Oh no, we haven't got any grey squirrels round here', or 'Yes, I see grey squirrels regularly in my garden'. When you compare it with the Foxwatch report, though the map is much more precise, the coverage is much poorer. The Foxwatch map showed that there were quite a lot of foxes south of the river, virtually none in the centre, but a number coming in along the linear features, mostly railway embankments, in the north of London. Beven's map is recorded by tetrads (4 km²), and no scale is given for the Foxwatch map, which does not show the borough boundaries although LWT divides its members into Borough Groups. LEU also uses borough boundaries. They have published a series of booklets on nature conservation in the various boroughs.

Under the aegis of the GLC, LEU were able to develop a consistent system of regional site designation, which is compatible with the planning system and which English Nature recognized when it drew up a series of maps showing the 319 sites of recognized nature conservation value in the East Thames Corridor (English Nature

1992). LEU sites are either of Metropolitan Importance or of Borough Importance. They also have a description 'of local importance within a borough'. I think we must bear in mind that the planning system and the public inquiry have become the main tool of responsible development in our area. When somebody wants to build something like a theme park on Rainham Marsh, there has to be a public inquiry. If there is sufficient evidence at that inquiry that the site is of significant nature conservation importance, then the developer has a battle on his hands and either the development (1) doesn't go ahead at all or (2) goes ahead in such a manner that the parts of the site most valuable for conservation are preserved. I believe that by designating a range of sites, the London Ecology Unit have done a real service by indicating to the planners and to the developers that these are sites which have a value over and above their sheer land value.

The planning system, under the control of the Department of the Environment, is the main body of law which conserves nature in this country, even though the Department of Transport can still drive — not a coach and horses, but a motorway — right through it; and the planning system operates on the basis of designated sites. That curious expression: 'East Thames Corridor' is also a planning term, meaning broadly 'the Thames Estuary', and it is an area scheduled for development by that same Department of the Environment. English Nature's report (English Nature 1992) lists 182 sites inside London and only 137 in Kent and Essex. Though any naturalist can see that the North Kent Marshes are far more valuable in terms of habitat, they are less protected in terms of designation. If we care about these habitats, we must be ready to provide records for them, identified by site, as at the moment, they are protected only by lack of development capital.

I have become aware that there are at least two different kinds of records — and probably all shades in between. We recently had a lecture from Dave Dawson of the London Ecology Unit about the kind of records that he finds useful when he is defending one of those sites in the East Thames Corridor — or indeed elsewhere — at a public inquiry. He needs records that are very precisely located: not just a site, but if possible, part of a site, though this clearly depends on what you are recording. Birds are very mobile. A lot of invertebrates are very immobile. But he needs records that are as precisely located in space as possible because he will be arguing that a particular part of a site is irreplaceable, and if it is a large site, the more detail there is about 'that species occurs on this site' the more useful the record. The other kind of record is for mapping species distribution. This is one we are very good at and have been using for some considerable time. I recently left a Council meeting with Mike Earp and argued all the way from Red Lion Square to Holborn Underground Station about the conservation value of mapping. He argued very cogently that distribution maps were extremely valuable for determining the national status of a species, as indeed they are. They are also useful for discussing local rarity or otherwise. If you are defending a site, however, they will only enable you to say that a given species occurs in that general area. Records for mapping species distribution tend to be by a grid square, like the squirrel map I showed you earlier. The Society usually uses tetrads or in some cases a 1 km². Records for local conservation, we are told, need to specify the site as closely as possible. It is also helpful if we can note abundance. I had another great debate with a botanist on effective use of time: 'You have only a limited amount of time in which to record a site. You are trying to make sure you have got all the species recorded and you simply haven't time to estimate abundance as well. You will never get it done.' My argument was that if you are trying to say that the site is valuable for preserving a particular plant, you need to know whether there was one individual or whether it is all over the place. Abundance is something that perhaps we haven't recorded traditionally, but is useful for nature conservation. If you are mapping, you really need to record everything, common and uncommon species alike. Of course people don't bother to record the common ones because they are all over the place. Rodney Burton (1992) cut down the work for botanical recorders by giving tables in *The London Naturalist*, of (a) plants common all over the area — only record their absence, (b) plants common in the outer 'country' part of the area — record their presence in the inner section, and

(c) five thoroughly urban species which are most abundant in built-up areas. The squirrel example shows that if you draw only what people have seen fit to record, you get silly maps showing the apparent absence of something which everyone knows to be common. If you are recording for conservation, you are really interested in the locally uncommon species rather than the things that are all over the place. We must give serious thought to how these two different purposes can be reconciled. Above all we must communicate a clear message to people who would like to record for us what we want and what it is for.

There are various national bodies involved in recording. The Biology Curators' Group became involved because most of our national recording centres are in museums. They helped to set up 'The Co-ordinating Commission for Biological Recording' (CCBR) in 1988. CCBR produced a thumping great questionnaire which they disseminated to everybody they could find who was doing any recording, saying: What do you record? What do you record about it? Do you use a computer? What are your aims? How many records have you got? How old are they?... It went on and on for ever. They found that 60 per cent of all species records are bird records, 29 per cent of all species records had been contributed by volunteers (97 per cent of bird records), while 29 per cent of habitat/landuse datasets had been generated by in-house staff (NFBR 1993). Another of CCBR's parents was the National Federation for Biological Recording to which we belong. These organizations recommend a computer package called RECORDER which is sponsored by English Nature and the RSNC. The author of RECORDER is Stuart Ball, an entomologist with the Joint Nature Conservation Committee. It is a biological recording package for sites. If you have done a survey, you can key in all the records for that site in a variety of different taxonomic groups quite quickly. If you have records going back over the past 20 years for great crested grebes from all over the London Area — no way. The package accepts records arranged by species only with the greatest reluctance.

All these people have recently become interested in recording largely because of the distinction that I made earlier between records for mapping and site-based records for nature conservation. Site-based records are needed for the planning process. This is why consultants who are employed to do Environmental Impact Assessments write to local naturalists saying 'Have you got any records for such and such a site?' The naturalist innocently, and feeling rather flattered, sends off any records that he has. The environmental consultant then binds them together with various extracts from publications into a fat report and charges the developer a handsome fee for it. So site-based records have become important for conservation and they have also become economically important. Site-based records are what RECORDER does.

I'd like to show you a couple of scales: the first is DAFOR. When you are recording plants on a site, you decide whether a particular species is Dominant, Abundant, Frequent, Occasional or Rare. With a bit of practice you can do this reasonably inaccurately but fairly rapidly. Invertebrate recorders didn't think 'Dominant' was appropriate, so for them the scale became ACFOR (Abundant, Common, Frequent, Occasional, Rare). Of course with invertebrates you get the most wonderfully slanted results depending on the collection method. Things count as abundant if you can catch them, not necessarily because theirs is the most abundant invertebrate species on the site. The second scale is the one that is used in the National Vegetation Survey, the Domin Scale. They thought that a ten-point scale would be nicer than a five-point scale. I have had only one reasonably serious attempt at using this new scale and I don't think I was any more accurate with ten points than I was with five. Once again it is something that can be applied pretty rapidly once you have the hang of it. These are two scales that are widely used. Domin is probably coming in. I think DAFOR is going out. Both are used to estimate abundance. It is not difficult and it is quick. Initially you get some silly arguments about whether a plant covers two per cent or five per cent of the area, but as the scales are pretty rough anyway, it really doesn't matter.

One of the Society's early efforts to make our records more accessible was based upon two computers, which the Society bought for the purpose. With the benefit of

hindsight, I don't think we would ever get enough data keyed in if we relied on only two computers. One of the things I asked in my survey was: Did people have computers? I was very encouraged to see that 37 per cent of the people who replied have actually got a computer and a quarter of them have IBM-compatible computers. That doesn't mean that they are going to have any time to key in records for us, but it does indicate that the level of computer usage in the Society has gone up pretty rapidly in the last eight years or so. More and more people either have them or have access to them and therefore, perhaps, getting a significant amount of our records on to a computer system is not entirely a pipe dream.

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Geological conservation in the London Area

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Summary

The setting up of RIGS groups throughout the country has altered the whole concept of geological conservation (Nature Conservancy Council 1988–92). Unfortunately London has the somewhat doubtful distinction of being the last in the queue to set up a group. More attention must be paid and will now be given to this form of nature conservation.

The importance of geology in the naturalists' world often gets overlooked and in some cases totally ignored. Geology is a subject which until recently was hardly taught in schools. Moreover a school qualification was not even required in this subject for university entrants wishing to include it in their courses. However geology now forms part of the National Curriculum and so may in the future play a much more prominent role. It is a subject which requires extensive field studies. The GCE A-level course requires at least ten days in the field. Hence much more attention must be paid to the conservation of geological sites. It should be remembered that such conservation was in the Government's mind when the royal charter for the Nature Conservancy was put in place in 1949. Under the charter the Nature Conservancy is specifically charged to provide scientific advice on the conservation, control and maintenance of physical features of scientific interest. The Nature Conservancy established an Earth Science division which proceeded to set up a network of sites of geological importance all over the country. Such sites are classified as National Nature Reserves and Sites of Special Scientific Interest. The first National Nature Reserve established primarily for its geological importance was the Wren's Nest, near Dudley. This was one of the richest sites in the country for fossils. One can find fossils from the Wren's Nest in museums all over the world.

In recent years there has been an extensive review of Earth Science SSSIs, called the Geological Conservation Review. Research potential has become a very important criterion for the designation of a site. Normal educational value on its own is not always a sufficient reason for designating a site, so a number of sites have lost protection as SSSIs. A classic example of this was the Clandon Traverse in Surrey. This was one of the finest teaching traverses in the country. Unfortunately it became a victim of the Geological Conservation Review. In the notice of its removal from the list of SSSIs the Nature Conservancy expressed the view that it should still be protected. To overcome such a problem the RIGS scheme was introduced. RIGS stands for Regionally Important Geological/Geomorphological Sites. Under this scheme a RIGS group is set up in each county to select sites requiring protection. Such sites may be ones which were former SSSIs, together with new ones which the group believes should be protected. Details of the sites are then notified to the county council planning office. The county planners are thus made aware of the geological importance of a site and can take this into account when dealing with planning applications affecting the site. The county RIGS group is made up of representatives of local geological societies, local natural history societies, the county wildlife trusts, colleges and often county council officers. Two Surrey County Council officers serve on the Surrey RIGS group. By the summer of 1992, RIGS groups had been set up in all the English counties except for the London area. During the summer of 1992 a planning application had been submitted to the Croydon Borough Council concerning the Rose and Crown chalk quarry at Riddlesdown. This was a former SSSI, but was still of very high scientific value since it shows the junction between the Middle Chalk and the Upper Chalk. Obviously this was a site which qualified to be designated as a RIGS, but there was no London group to handle it. Surrey RIGS group decided to take responsibility for the site and declared it a RIGS. Concern over the lack of a Greater London RIGS group

was expressed to this Society's Council, and it was agreed that steps should be taken to remedy the situation. However, in the end the matter was resolved when the Geology Department at Greenwich University launched a group at the Geologists' Association Reunion in November 1992. Two members of the group visited the Rose and Crown quarry where a video record was taken. Unfortunately progress by the Greater London RIGS group appears to have stopped and during 1993 little appears to have been done. One disappointing aspect of the RIGS scheme in the Greater London area has been the failure of the London Wildlife Trust to join it. My own approaches to the Trust, one of which was in connection with the Rose and Crown quarry, have failed to produce any results.

Until 1982 the Society had a conservation committee which held a watching brief over sites within the Society's area and supported opposition, when appropriate, to any development proposals. Geological sites were included. The committee reported to Council and these reports were published in *The London Naturalist*, and from time to time officers of the Nature Conservancy produced material for publication. With the formation of the London Wildlife Trust, responsibility for nature conservation passed out of the hands of the Society to the Trust. I am of the opinion that it is highly desirable that there should be co-operation between all bodies concerned with nature conservation. Many sites are not just protected solely for their geological interest. A classic example is Hampstead Heath. The Heath has lost its SSSI designation as a geological site, but is a prime candidate for designation as a RIGS. Not only is it of pure geological interest, it is also of geomorphological interest and the gathering ground for a number of streams.

The Surrey RIGS group has declared about 20 sites as RIGS. Some are just on the fringe of the Society's area and include the Nower Wood Educational Reserve, the abandoned meander of the River Mole in Norbury Park and the ancient swallow holes of the River Mole near Burford Bridge. Further east the former SSSI, the chalk pinnacle of Nore Hill, has also been designated. This already had protection as a local nature reserve. Some dozen RIGS have been designated in Hertfordshire. Among those within the Society's area are two which show the well-known Hertfordshire Pudding Stone.

There are a number of sites which have been suggested for Greater London. As already mentioned only one has been designated, the Rose and Crown chalk quarry at Riddlesdown. Another former SSSI is the Kenley Station chalk-pit which may be taken in hand by the Surrey RIGS group. In the eastern part of the Society's area is another former SSSI, the North End pit in the Crayford brickearths. This is also important archaeologically since the brickearth yields flint artefacts. I have received a report on the state of the pit from Bexley Council. If the Greater London RIGS group is unable to operate it might be possible for the Kent RIGS group to inspect it.

The dinosaur models in Crystal Palace Park have recently attracted attention as an educational site and could be the first RIGS to be declared by the Greater London group. A number of papers have been published recently in the geological literature pointing out their educational value, for example, Doyle and Robinson (1993). In addition there are other items of geological interest in the area where they are located. A type of geological theme park had been originally envisaged. Other possible RIGS could be the Pinner chalk mines, Chislehurst Caves, Hampstead Heath and its associated pit in the Bagshot Beds.

The most important site within the Society's area is without doubt the Barnfield pit at Swanscombe. This is a National Nature Reserve declared in 1954. It was presented to the Nature Conservancy by the Associated Portland Cement Manufacturers. It is a gravel-pit exhibiting exposures in the Swanscombe (Boyn Hill) terrace of the River Thames. The gravels have yielded extensive remains of elephant, lion, rhinoceros, deer, bison and a number of extinct animals. However, in 1935 A. T. Marston found a piece of human skull. He found a further piece in 1936 and a third piece followed, being found by J. Wymer in 1955. All three pieces fitted together and obviously came from

the same person. This human being lived about 250,000 years ago and belonged to our own species. This site is regarded as being of prime international importance. The pit has also yielded large amounts of flint implements. Collecting here is now prohibited. A number of geological SSSIs are still in place. First and foremost is the pit in Maryon Park, Charlton. This is the last good exposure within London of the Lower Tertiary deposits ranging from the Thanet Beds up to the Blackheath Pebble Beds. The intervening Woolwich Beds yield a number of fossil shells. This was a working sand-pit until 1938 and was taken over by the then LCC as a local geological reserve. It is now controlled by the Greenwich Borough Council and access to it is by permit from that council. Collection of fossils and digging in the pit are no longer permitted. It is a very valuable site for the teaching of geology.

A short distance eastwards of Charlton is the Abbey Wood site. This is a small area in fossiliferous Blackheath Beds. It was once a popular place for collecting fossil sharks' teeth, but these are now very hard to find. The actual fossiliferous bed is some distance below the surface, but digging to it is not permitted.

The Harefield chalk-pit is a very important geological SSSI since it shows the junction of the Tertiary beds with the Upper Chalk. The chalk surface exhibits a plane of marine erosion and is bored by marine organisms. The Tertiary strata consist of the Reading Beds capped by London Clay. The feature of the marine organism borings into the chalk is shown in other pits to the west, e.g. Pincent's Kiln near Theale in Berkshire, and still has a lot of research potential. The Harefield pit is monitored by the local geological society.

Just outside the Greater London area but within the Society's area are the swallow holes at Water End, North Mymms. Here the northern flowing Mimmshall Brook disappears down swallow holes in a field behind the Water End hamlet. Evidence suggests that the water follows an underground course to the River Lea. In wet weather, when the water supply is much greater, the swallow holes cannot cope and a temporary lake is formed. This lake has an overflow channel to the River Colne. The geological history of the Mimmshall Brook cannot be detailed here but it is bound up with the Pleistocene glaciations.

Geological conservation in the Society's area presents many major problems. A lot of these will be overcome if the Greater London RIGS group is able to deliver and make up lost ground. It is hoped that the London Wildlife Trust will come into line with other county trusts to support the RIGS group.

Full details on RIGS notification within the Society's area will be made available in a future paper.

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Book review

Field guide to wild flowers of Britain and northern Europe. Bob Gibbons and Paul Davies. The Crowood Press, Marlborough. 1994. 320 pp. £9.99. ISBN 1 85223 07848.

The best thing about this pocket-sized book is the price. For your tenner you get almost 750 colour photographs, i.e. not much more than a penny each. Many of them are very good, though the variations in scale can be disconcerting. There are even pictures of duckweeds and rigid hornwort which in practical terms are not flowering plants.

If it were simply presented as a collection of photographs, there would be nothing one could say against the book. Its claim to be useful as a field guide requires a lot of comment. It admits to limitations in scope, omitting for instance grasses, sedges and rushes, and justifies them by reference to other works mentioned in a bibliography which unfortunately is simply not there. Apart from these, it is said to cover 'virtually all the flowers likely to be found by the user in the area covered', but there is no mention of snapdragon, keeled corn-salad, Chinese mugwort and sticky groundsel, to name but a few. The recommended initial approach to the book is to 'scan through the pictures until finding something that looks similar to the species to be identified'. What a shame, therefore, that there is no picture of orpine, water-purslane, moschatel, fluellen (either species), Cornish moneywort, red bartsia, shoreweed, gallant soldier, Canadian waterweed or white helleborine, all flowers which to the untutored eye are surely quite unlike anything illustrated. 'If the species (*sic*) cannot readily be matched with a picture, find the plant that seems to be most similar ... and check the text for similar or related species to see if any of these fit better.' That would be fine if there was any correspondence between the grouping of plants and the selection of subjects for photographs, but there is not. Alpine catchfly is similar to the unillustrated sticky catchfly, narrow-leaved helleborine is similar to white helleborine. Alpine bearberry which is illustrated (in fruit!) is similar to bearberry which is not. No one will ever identify cornelian cherry *Cornus mas* from this book, on the basis of no picture and its supposed similarity to dogwood.

A paragraph in the introduction to this book gives the whole game away by referring to the relative merits of photographs and paintings in the process of identifying flowers. The authors claim that 'photographs can often capture the essence of a plant, the way it grows and holds its flowers, better than a painting of isolated leaves and flowers.' The fact of the matter is that it is now economic to produce volumes like this one in a way which was quite impossible at the time of publication of, say, McClintock and Fitter's *The pocket guide to wild flowers* (1956), which can be written round the available photographs, leaving out those which the photographers never got to, at least not on a good day. Paintings, on the other hand, can be chosen before they have been produced, and done from pressed specimens if the worst comes to the worst. The artist does not have to worry about lighting conditions or confusing backgrounds.

Worst of all, the photographs in this book labelled small-flowered cranesbill, Highland cudweed, short-fruited willowherb, moth mullein, peach-leaved bellflower and field garlic all represent other species.

RODNEY BURTON

James Mitchell's *The Thames Tunnel* — unpublished notes by an amateur geologist, August 1839

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Summary

Joseph Prestwich, MA, FRS, FGS, presented to the Geological Society of London in 1889 five bound and indexed volumes of manuscript (Geological Society 1890). In a letter to Council he explained that 'My early friend Dr James Mitchell, who was a Fellow of our Society, made a large number of observations on the Geology and Botany in the neighbourhood of London during his residence in the City between the years 1830 and 1845. His notes were copied and bound in five large volumes folio.'

Mitchell's unpublished piece entitled *The Thames Tunnel* describes the first sixteen years of work on Sir Marc Brunel's tunnel under the River Thames at Rotherhithe. The text here presented is a transcription of handwritten notes occupying pages 27 to 36 in the last of the five volumes. The paper used by Mitchell has watermarks dated 1838, and the piece is dated in his own hand, August 1839. No alterations to the text have been made, other than a few necessary punctuations.

Tunnels under the Thames — an introduction to Mitchell's notes

In the opening paragraphs of *The Thames Tunnel*, James Mitchell briefly mentions two previous attempts to make a tunnel under the Thames downriver from London Bridge, the first in 1799 to link Gravesend with Tilbury, and the second in 1804 between Rotherhithe and Limehouse.

The first, it was thought, might offer military advantages, and an Act of Parliament in 1799 authorized a tunnel or road under the river from Gravesend in Kent 'to or near to Tilbury Fort in the County of Essex'. The distance from bank to bank was about half a mile, and a shaft was begun in chalk on the Kent side. By the end of 1802 after two years of floodings and delays it had reached a depth of only 85 feet, conclusively proving itself at that point to be beyond management, and was abandoned.

The Act for the next attempt was obtained in 1805 to make 'an archway or archways' under the river between Rotherhithe and Limehouse, to be passable for livestock, carriages, and pedestrians. Work commenced with a shaft at Lavender Lane, Rotherhithe (later the site of Lavender Pond in the Surrey Docks). At about 40 feet depth, groundwater overwhelmed the pumps, and the sinking could be continued only at a reduced width in the shaft. Richard Trevithick joined the operations in 1807, and began a narrow driftway in the London Clay under the river. The work reached a point within 150 feet of the northern shore, and on a day when Trevithick was at the cutting face a great torrent of sand and water burst in, quickly filling the tunnel. A crater in the bed of the river above the breach was stopped with bags of clay dropped from boats, but hostile opposition, claiming that this activity obstructed navigation, brought an end to hopes of recovering the tunnel, and it was abandoned.

A third attempt, which Mitchell called 'the present tunnel', owed all its probability of success to Marc Brunel, who introduced two new and fundamental improvements in tunnelling procedure; firstly, a movable iron shield at the working face, and secondly the practice of lining with brick and cementing new sections of wall as soon as they were exposed. It is said that Brunel used the wood-boring ship-worm *Teredo* as a model for his invention. Work began in 1825 with a shaft at Cow Court, Rotherhithe, three-quarters of a mile west of Trevithick's tunnel.

Mitchell's manuscript gives an account of progress up to 1 August 1839, noting the severe difficulties caused by repeated inundation, firedamp, and deadly hydrogen sulphide. After the first major flooding on 18 May, 1827, three eminent geologists, William Buckland, R. I. Murchison, and G. W. Featherstonhaugh, took turns in a diving-bell lowered into the Thames from a boat to see the hole in the bottom of the river above the breached tunnel. Then, in what Murchison was later to call an act of folly, he further allowed himself to be taken by boat into the dark and flooded workings under the river, whereupon the man who was holding the only source of light fell overboard.

A second major breakthrough of water in January 1828, and shortage of money, caused the operation to be suspended. It remained so for seven years, and Mitchell's narrative ends in 1839 during this period.

In 1840 work began on the northern entry shaft at Wapping, and the tunnel was at last opened to pedestrian traffic in March 1843. The ramps for vehicles were never made, and for twenty-seven years the tunnel had virtually no wheeled traffic. The East London Railway Company converted it to railway use in 1870, and it is now part of the London Underground system.

The Thames Tunnel — James Mitchell's MS, August 1839

'The tunnel under the River Thames from Rotherhithe to Wapping is one of the most remarkable works ever undertaken. It is not however the first attempt. A project to carry a tunnel below the river at Gravesend was commenced in 1799, but soon abandoned.

'In the year 1804 there was a plan to carry a tunnel from Rotherhithe to Limehouse, but on a small scale compared to the present. A shaft was sunk 11 feet in diameter to the depth of 42 feet, and then from this depth the shaft was carried downwards only 8 feet in diameter, the area being little more than half of the upper shaft, to a further depth of 30 feet, making altogether 72 feet. From this depth a small driftway was carried forward 920 feet, being to a point within 150 feet of the shore, when it was deemed expedient to abandon the work as impracticable. The driftway had arrived amongst sand and pebbles, in which was so much water that it was impossible to proceed.

'In 1823 the present tunnel was projected by Mr Brunel, and an Act of Parliament was obtained in 1824. Mr Brunel began by sinking a shaft on the Rotherhithe side at a distance of 150 feet from the river, and to a depth of 65 feet. The diameter was 50 feet. As compared therefore with the shaft sunk in the former attempt the area of a horizontal section was as 2,500 to 121, or upwards of 20 times as large.

'Before sinking this shaft a cylinder of brickwork, firmly cemented and of which the wall was three feet thick, was erected over the space marked out, and on the top of this cylinder a steam engine to raise the earth and water was placed. The interior was then dug, and also the ground gradually taken out from beneath the brickwork, by which means it was gradually lowered down, and thus the engineer was enabled successfully to pass through a quicksand near the top, of about twenty-six feet in depth. This quicksand is exactly similar to that in which the driftway of 1804 was stopped, and it was probably a continuation of the same stratum, only separated by the stream of the river.

'After this shaft was completed a smaller shaft of only 25 feet in diameter was sunk, which therefore left a clear space of 9½ feet between this shaft and the wall of the upper shaft. This lower shaft was carried down 15 feet, making altogether with the depth of the upper shaft 80 feet from the surface, when the brickwork all at once sunk some feet into a bed of sand and pebbles in which was an abundance of water, in fact it was a quicksand. All that could now be done in this part was to repair the brickwork of this lower shaft, and be contented without sinking deeper.

'The experience obtained in digging all the wells of the Metropolis shows that below the London Clay, and above the Chalk, there is a bed of sand or of sand and pebbles in which water is usually found. The precise depth at which this bed is to be met with, is not uniformly the same, and in some localities it would have been at a lower level than in this instance, yet there was no very great deviation from the ordinary experience in meeting it in the locality of Rotherhithe at the depth of about 80 feet from the surface.

'The excavation of the tunnel was begun at 63 feet in depth, being 2 feet above the floor of the large shaft. The width is 38 feet and the height is 22½ feet: the upper part therefore is little more than 40 feet from the surface. For greater security it was formed at a declivity of 2 feet 3 inches in 100 feet. The tunnel commenced in a bed of stiff solid blue clay on the 1st January 1826, but

after proceeding forward successfully until the 25th of January 1826 they came upon a break in the clay, filled with sand, gravel and water. With some difficulty and danger this bed was passed by the 11th of March and solid clay was again found.

'The work had proceeded upwards of 400 feet under the river when the ground became exceedingly bad, and the water broke in on the 18th of May 1827. The tunnel was however soon cleared, and the work again went on, until January 1828, when a similar calamity again occurred. The place where the break then took place was closed by bags of clay, and the water was pumped out from the interior of the tunnel, when the works were found not to have been injured.

'The funds of the Joint Stock Company which had undertaken the work were however now nearly exhausted, and the shareholders were too much discouraged to make any further steps to raise more money, and accordingly the work was suspended for about seven years. Government at last agreed to lend a sum of £270,000 and the work recommenced. By proceeding very cautiously, and strengthening the bed of the river over the tunnel by bags of clay, the work has since gone on very securely though slowly.

'Latterly some inconvenience has been experienced by the workmen from the explosion of carburetted hydrogen gas [CH_4]. Some of them have also been disabled from working for a time by blasts of sulphuretted hydrogen gas [H_2S], and have been carried off senseless, when their services were much wanted as the gas was bursting out and carrying all before it with inconceivable violence. Some chemists have supposed that the gas might be hydro-sulphuret of ammonia [NH_4HS]; but Mr John Thomas Cooper who has analysed it has informed me that he discovered no ammonia whatsoever.

'The present position of the tunnel on the 1st August 1839 is, that the top is 24 feet below the bed of the Thames, and it is within 15 feet of low water mark on the Middlesex side. The whole length of the excavation from the shaft is upwards of 900 feet, and there remains about 400 feet to be excavated, to bring the tunnel to the place where it is proposed to form the entrance on the Middlesex side. The whole amount of money already expended is about £300,000.

'The facts stated in this paper have been obtained from a short account published by the Directors of the Tunnel Company, from some additional particulars in the supplement to the Mining Journal of 31st July 1839, and also from information of Mr Cooper mentioned above and a personal inspection of the works.'

Acknowledgements

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Book review

Building green. A guide to using plants on roofs, walls and pavements. Jacklyn Johnston and John Newton. London Ecology Unit. N.d.[1993]. 95 pp. £12.95 from bookshops, or £14.20 post free from the LEU, Bedford House, 125 Camden High Street, London NW1 7JR. ISBN 1 871045 18 5.

This handbook marks a significant new departure for the London Ecology Unit. Their central concern has always been, rightly, for the study and protection of London's increasingly threatened green spaces. This concern has been well demonstrated in their highly successful series of handbooks covering the nature conservation interest of an increasing number of London boroughs (two of which are reviewed elsewhere in this journal). Until now, however, relatively little attention has been paid to the potential ecological and environmental benefits of greening the built structures themselves. *Building green* focuses on one key aspect of this greening process: the use of plants on and around urban buildings.

A short opening chapter discusses the 'The Natural Landscape of the City' in which the work of the German landscape planner, Hermann Barges, is commended. He suggests a valuable metaphor in which the city can be looked at from a new perspective. Urban areas are compared to 'concrete mountains with streets like valleys; roofs of buildings correspond to alpine meadows and pastures and the walls to slopes and terraces'. This ecological approach suggests the types of plant which are most suited to each aspect of the urban environment. An outstanding natural example of this, though not mentioned in the book, is the way in which the butterfly bush *Buddleja davidii* has colonized the decaying brickwork of city walls and railway bridges — artificial structures which mimic the cliff-side habitats of western China, where the plant occurs as a native.

The authors then discuss the importance of trees in urban areas and the many environmental benefits which they can bring. All too often they are viewed as mere decorative afterthoughts. I was pleased to note that non-native trees were encouraged in addition to the more generally recommended indigenous species. The much-maligned sycamore, for example, can provide a valuable source of food for huge numbers of aphids and other insects which support a good range of birdlife. There is a detailed account of the rather specialized planting procedures required for the successful establishment of trees in the harsh environments of the city. The importance of water supply and after-care are also emphasized and should result in a far higher survival rate than is generally achieved.

Further chapters discuss 'balcony gardens', 'green walls', 'building for birds and bats' and 'green roofs': I found the last particularly stimulating and am busily investigating the possibility of turfing over my own flat extension roof. This could not only provide an interesting habitat, but might also supply some useful additional thermal insulation for the room beneath. Care will need to be taken, however, to ensure that the existing roof structure is strong enough to support the additional weight involved. Load-bearing tolerances on buildings are usually pretty tight and the large increase in roof weight could prove catastrophic. An alpine meadow on the roof will not be appreciated if it suddenly becomes a rocky ravine! I would have appreciated some more detailed guidance on ways of strengthening existing roofs.

A final chapter looks at the role green buildings can play as a contribution towards sustainable development. Examples are given of large-scale projects involving innovative solutions to environmental problems. One discusses the renaissance of a run-down inner-city district in Berlin. This includes the novel concept of a 'vertical swamp' filtration system, constructed on the side of a building where greywater filters through successive planters containing suitable swamp grasses arranged down the building's façade.

The handbook concludes with a helpful section of technical information. This includes a short list of recommended trees for urban situations and despite a heart-felt plea earlier in the text for 'adventurous choices', I have to say that I found their list of sixteen trees rather predictable. London plane, Norway maple and whitebeam were unexciting choices when there are so many fine ornamental trees available. The lists of suitable herbaceous plants for different situations were much more useful, although I believe musk mallow *Malva moschata* would be a better choice than the rather dull common mallow *Malva sylvestris*, which is recommended as a grassland plant.

This is an inspiring book, which I greatly enjoyed reading. It is illustrated throughout with colour photographs and line drawings. I hope that its many innovative ideas will be taken up by the architects and planners who can put them into practice.

DAVID BEVAN

James Mitchell's *Brickmaking* — an early nineteenth-century study in economic geology

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Summary

Joseph Prestwich, MA, FRS, FGS, presented to the Geological Society of London in 1889 five bound and indexed volumes of manuscript (Geological Society 1890). In a letter to Council he explained that 'My early friend Dr James Mitchell, who was a Fellow of our Society made a large number of observations on the Geology and Botany in the neighbourhood of London during his residence in the City between the years 1830 and 1845. His notes were copied and bound in five large volumes folio.' Mitchell's work entitled *Brickmaking* appears in Volume 1, pages 218–231.

Introduction

James Mitchell, LL D, FGS, was an immensely industrious Scot, first a schoolmaster, later an author, a company secretary, and a Parliamentary Subcommissioner (Allibone 1875). The *Dictionary of national biography* (Clerke 1975: 1386) lists eight of his published works, mainly encyclopaedic or instructional in nature; and a Geological Society Library index names fifteen geological papers. But it is through the measured phrases of an obituary notice in the *Gentleman's magazine* (1844), the year of his death at the age of fifty-eight, that Mitchell's personal character emerges. For example, it was said during the proceedings of a Parliamentary Inquiry into the Condition of Women and Children in the Mines and Collieries, that:

'In the debate on the bill for relieving the worse than West India Slavery of Women, and may we say of Infants, in our Mines, his opinion was frequently referred to in both Houses of Parliament.'

And the obituary continued:

'To the duties of this last Commission, uniting both his favourite pursuits of Geology and Statistics, he devoted more labour and attention than his constitution could stand.'

In another passage, Mitchell's clarity of exposition was contrasted with the high-flown rhetoric found at the Geological Society:

'... and whilst in the Geological Society, many were more brilliant in inventing their beautiful but perhaps sometimes fanciful theories — no one was clearer and more minute in detailed description of what he had actually seen.'

Reading this obituary notice one senses the writer's unease as he steps carefully among his words. It is as though there were something more to be understood, though left unsaid, a sense of disquiet that could have arisen from Mitchell's description of the state of things he found at the Geological Society, to which he had been elected Fellow in 1832. Two years later he wrote to a friend:

'I assure you it is not sufficient to be a Fellow; if you be not also high in office you do not get justice. There is a certain set of elder brethren, members of the Council and ex-members, who monopolise as much as they can, both in the *Transactions* and in the speaking at the Society; and a new man has to fight his way through them' (Woodward 1907: 135).

Towards the end of 1889, forty-five years after Mitchell's death, Joseph Prestwich proposed to the Society's Council that a collection of manuscripts in his possession, which had been bound into folio volumes by Mitchell many years previously, should be deposited in the Society's library. The Council agreed without delay, for the manuscripts contained economic and practical information, particularly borehole

measurements, which had contributed significantly to an already published Geological Survey Memoir (Whitaker 1889).

Mitchell's manuscripts run to one thousand three hundred and seventy pages. They range through a variety of topics connected with geology and plant-life in the London area, and include also industrial technologies — lime-burning, cement-making, brick-making, tunnelling, and water-well sinking. They present a true and unadorned narrative of an amateur geologist's observations during the pre-Victorian years of the nineteenth century, and thus have historical as well as geological interest.

Judging from internal evidence in the notes, and from dated watermarks in the paper itself, the five volumes span a period of eight or nine years between 1832 and 1840. The extract here presented describes brick manufacturing in and near London. It is a transcription of handwritten text occupying pages 218 to 231 in the first of the five volumes. The writing-paper used by Mitchell in this volume has watermarks dated 1833 and 1834; the second volume has paper watermarked 1835, suggesting that the account of brickmaking in the London area was compiled during 1834. Most of the manuscript seems to be in the handwriting of an amanuensis or copyist, though later insertions, judging by their style and content, are likely to be Mitchell's own.

No alterations to the text have been made, other than a few necessary punctuations and initial capitals.

Brickmaking — James Mitchell's MS

'In the manufacture of bricks near London the materials used are clay, sand, chalk, and breeze. The clay is generally obtained in the field where the bricks are made; and it is a great saving of expense to a builder if the ground on which he builds be of such a nature as to be capable of being made into bricks. The clay is usually of a brown or red colour, which is produced by a portion of iron mixed with it. A certain portion of sand in the clay renders it more fit for the purpose. Sometimes it is necessary to bring clay from a short distance to use with the clay in the brickfield. Sometimes sand must be brought for that purpose.

'In the brickfields at Counterhill near New Cross, and at Acton in Middlesex there is a portion of calcareous matter in the clay which the workmen call *race*, consisting of particles of the size of mustard seed. It makes the bricks harder, more durable, and better looking, being of a fine yellow colour. If the particles of calcareous matter, as at Shepherds Bush, be of the size of pease they produce decrepitation and explosion in burning.

'There is a very fine soft sand which is thrown on the shore of the River [Thames] opposite to Woolwich, and also on Crayford point, which is used in brickfields for the moulds of the bricks. This sand is sprinkled on the mould by the brickmaker after every brick is taken off, and the object is to prevent the clay adhering.

'Chalk is mixed with the clay for making the finer species of bricks called Malm Bricks. For ordinary coarse bricks called Stock Bricks chalk is not required.

'The breeze is the refuse or small cinders obtained from the dust or ashes of the coal fires of London. The smaller size the breeze so much the better. It is mixed up with clay in making bricks, and thereby it assists very much in the process of burning them. The breeze has also some sort of chemical action upon them by which it hardens them. One third breeze to two thirds clay is a usual proportion.

'There are Patent bricks made by Mr Rhodes in the Clapton fields, in which coke is ground down to a fine powder and mixed with the clay. The principle is the same as that in making common bricks; but from the fineness of the powder produced by the grinding of the coke the operation is more equal and perfect throughout. The bricks made by this patent however do not fetch a higher price than other bricks; and there are architects who do not think them quite so good, not being so hard.

'The Blue Clay which is very abundant in and about London, though seldom at a less depth than twenty or thirty feet, is not well adapted for brickmaking, and therefore is little used as an abundance of more convenient material is easily obtained.

'Bricks made of the Blue Clay would shrink in the drying and burning more than those made of other clay. It is said also that the bricks would be much more apt to run together in burning. It is easy to try the experiment by burning for half an hour a lump of Blue Clay in the fire. It is reduced to half the former size, and becomes quite red.

'Where however Blue Clay is abundant and other clay is not to be obtained good bricks may be made from it by adding a great quantity of sand, at least as much as the clay itself. Some millions of bricks were made in this way by Mr James Frost at Harwich, when he was employed by Government in building the fortifications at that town, and on the neighbouring coast.

'Near London fire bricks are made from Blue Clay and sand. They are burnt in a tile kiln and are very hard. They are used for setting coppers and grates, but are not so good as Welch bricks. They are also used for paving; and for the floors of wash houses.

'Clay which is intended to be made into bricks is generally dug up, and wheeled a little way off by barrows, and thrown down to be exposed to the air and moisture in the winter months. The clay is sometimes turned to bring more completely the whole into contact with the air. It is also turned after the breeze is spread over it, in order to effect a thorough mixture together. The clay is then sufficiently prepared for the common bricks called Stocks. When it is used it is put into a mill merely to thoroughly mix it and to soften it so as to be made plastic in the hands of the brick-maker.

'At a great brickfield on the south west of Norwich the clay is prepared for the brickmaker by being trodden by horses, and sometimes by the naked feet of boys. In some parts of the country the work is done by a small mill worked by the hand — letter from Mr Samuel Woodward. Treading clay by the feet is practised in many parts of the country.

'The bricks are arranged in lines in the fields to dry, and straw is laid over them in wet weather. Bricks when dried as far as they are likely to be by the action of the atmosphere, are taken and built up in large square masses, technically called clamps. In the interior there is fire for the purpose of burning them. Sometimes mud is plastered on the outside of the clamps to prevent the too easy access of the air. The process goes on a little more slowly, and if the heat be not quite so great it continues for a greater length of time, which seems to be necessary in order to effect the purpose intended.

'Considerable practical skill and caution are requisite in burning bricks. If there be excessive heat the clay vitrifies and the bricks run into masses, from which they cannot be separated. Such masses are of very little value, and can only be used for filling up foundations.

'Breeze or cinders is a much better material to mix with the clay than small coal; because if the latter were used the burning would be much too rapid. The mud plastered on the outside tends to prevent this vitrification when it is intended to cool them. After these clamps have become cooled the bricks are separated into several kinds which have been produced by the inequality of the heat in different parts of the clamp.

'*Stock Bricks* are the most abundant sort. These are sold at from 30 to 40 shillings a thousand. The thousand is exactly the number usually so called, and not 1200 or any other arbitrary number.

'*Picked Stocks* are the best sort of stocks selected by themselves. They sell at 1 shilling and 6 pence or 2 shillings a thousand more than Common Stocks.

'*Place Bricks* differ from the Common Stocks merely in not having been so well burnt. When the bricks have been taken down from the clamps, such as are observed not to have been sufficiently well burnt are laid aside by themselves. They may be made to answer for works not so much exposed to the weather. Place Bricks sell for 8 shillings the thousand cheaper than Stock Bricks. If the bricks be too soft even for such purposes they must be burnt again; and such have the name given them of *burnt overs*.

'*Washed Bricks* are greatly superior in quality and appearance to Stock Bricks. The materials of which they are made are clay very finely comminuted in a mill and carried off from it by water; and a certain proportion of chalk also very finely comminuted and very thoroughly combined with it. The machinery is sometimes put in motion by means of a steam engine, but much more frequently by a horse or by two horses.

'The process may be seen in every large brickfield. The clay is thrown into a sort of pond; and water is pumped upon it, and the machinery has long teeth like a harrow which separates it into fine particles; the machinery at the same time also grinds the chalk, which is in another enclosure by itself, and works a pump which gives a supply of water to the chalk, and to the clay. A little stream of water in which the bruised chalk is thoroughly diffused is constantly flowing into the pond holding the clay, and is thereby thoroughly combined.

'From this pond of clay and chalk mixed together a little fluid stream is constantly flowing along a spout which carries it to places in the field for its reception. All pebbles and other coarse matters are left behind. The clay and chalk sink to the bottom and water runs off. There are different degrees of perfection in the washing or preparing of the materials.

'When enough has been obtained the material is left to dry; it is then mixed with the breeze and the whole passes through the brickmakers mill and is made into bricks in the usual way. From the more perfect state of the material the bricks are stronger and have a much better general appearance and colour. There is a chemical action in the process of burning between the clay and the chalk which tends to harden the brick very much.

'The Washed Bricks after being burnt in clamps and being cooled are taken down, and separated into several kinds:

| | |
|---------------|---------------|
| Malms | Malm Pickings |
| Malm Paviours | Malm Seconds |
| Malm Place | |

'*The Malms* are those bricks which are uniformly and soundly burnt. They are worth from three to four pounds the thousand. These bricks are well adapted for the best kind of building and from their handsome appearance and durability are suited for the outside of houses.

'*Malm Paviours* are such bricks as become excessively hard in the burning. They are quite unfit for the same work as the Malms, and from the cracks and rents in them they have not such an appearance as to fit them for the outside of buildings. They sell for about 45 shillings a thousand. They are used chiefly for paving yards and for the floors of stables.

'*Malm Place Bricks* are such as have not been well burnt. They are of very inferior value as they cannot be used except for the inside work, where much strength is not required, and where there is no exposure to the weather.

'*Malm Pickings* are a little better than the Malm Place.

'*Malm Seconds* are harder and of a better colour than Malm Place. They will do for facing houses of an ordinary description. They sell for ten or twelve shillings a thousand more than Common Stocks.

'*Cutters* are a species of washed bricks differing from those described in not having as much breeze mixed with the clay before burning. They are tough, but may be rubbed to any shape or may be cut with tools without flying to pieces. They are used in the building of arches. The price of Cutters is the same as Malm Bricks.

'The prices of bricks vary much at different periods. On February 6th, 1836, the following statement of prices was given by a clerk of Mr Rhodes:

| | | | |
|---------------|---------------------|-------------------|-----------|
| Place Bricks | £1. 5. 0. per 1,000 | Malm Seconds | £3. 0. 0. |
| Stocks | 1.12. 0. | Cutters | 5. 0. 0. |
| Malm Pickings | 1.12. 0. | Red Paving Bricks | 2.10. 0. |
| Malm Paviours | 2. 5. 0. | | |

'Brick kilns are sometimes used for burning bricks. They produce a more powerful heat than the clamps with the same quantity of fuel, and would be more generally employed were it not for the additional expense of constructing them.

'Where brick kilns are employed then bricks may be burned in making which no breeze has been mixed with the clay, and consequently such bricks will be much freer from vacuities such as are left in common bricks when the breeze is dissipated by burning. The common bricks which are burnt in clamps are less adapted for resisting rain, which is almost sure to penetrate and spoil the paper of the house after a long continued rain and a south west wind. Kiln bricks cost about twice as much as clamp bricks. It is however chiefly for the burning of tiles that kilns are used. They may be seen in the Hackney Road and also down the Green Lanes.

'*Suffolk Bricks* imported from Ipswich to London are of a very white colour. Some white sand is mixed with the clay to render it more plastic. No breeze is employed. These bricks make the nearest approach of any to Bath Stone. Many of the houses in the vicinity of London Bridge have been faced with these bricks. The price is from £4 to £6 the thousand.

'*Stourbridge Bricks* are imported into London from Worcestershire by the Canal. They are made of coarse clay for such work as is to be exposed to fire, for which purpose they answer in ordinary cases, though they are much inferior to Welch bricks where very great heat has to be endured.

'*Welch Bricks* are imported into London to be employed in building furnaces and other works exposed to very great heat. These bricks are of a very large size. The material of which they are composed is clay with a mixture of iron ore, by the action of which two things together the capacity to endure heat is produced.

'*Tiles* are made from the Blue Clay, which when burnt becomes quite red in colour. No breeze is mixed with the clay, nor yet any sand; except for the moulds. The clay must be very adhesive and clean. It is turned over two or three times to be weathered. It is not washed, but when

manufactured it is made to pass through the mill to mix it and render it plastic. Tiles are so placed in the kilns that they are prevented from running together.

'When bricks come from the mould they are of the following dimensions:

| | |
|-----------|------------|
| Length | 10½ inches |
| Breadth | 4¾ inches |
| Thickness | 2¾ inches |

'After being burnt the dimensions are found to be considerably reduced:

| | |
|-----------|-----------------|
| Length | 8¾ to 9 inches |
| Breadth | 4⅛ to 4¼ inches |
| Thickness | 2½ to 2⅝ inches |

'No larger dimensions can be used, in consequence of the Act of Parliament imposing a tax on the thousand bricks and prescribing a maximum size. By special application where a reason can be shown the Commissioners of Excise may grant permission to make bricks of other dimensions.

'A brick and a half with mortar will make a 14-inch wall: 2 breadths of brick with mortar will make one length: 4 courses of brick with mortar will make 11½ inches or 1 foot in height.

'Bricks are very porous. When placed in water a common brick will perhaps absorb as much as a pint. When cement is to be used with bricks they must first be soaked in water, otherwise they will absorb all the water from the cement which comes immediately in contact with them; and the consequence is, that there will be a film which will not set, and the cement will fall off.

'Bricks differ much as to the quantity of water which they will absorb. The following statement has been given by a builder:

| | |
|------------------------|---------------------|
| Stock Brick | 1 lb. water |
| Malm Brick | 3 lb. water |
| Canterbury White brick | 4 lb to 7½lb. water |

'An attempt was made by some rash speculators to make bricks from the soil in the marshes on the north side of the Thames below Little Thurrock, and opposite to Northfleet. It had been observed that there was a great deal of vegetable matter mixed with the clay, and it was supposed that this would so much facilitate the burning, that a great profit would be made. Accordingly a lease was obtained, and an immense preparation was made, and many thousand bricks were formed, and afterwards built into clamps and burnt. It turned out, sure enough, that the bricks burnt very easily; but they were good for nothing. They were so light and porous that many of them would swim, and were shrunk to a very small size and quite out of shape. In fact they were of no value and some thousand pounds were lost by the speculation.

'The imprudence of not first making some bricks, and burning them, and seeing how they would answer, before so much money was spent seems almost incredible.'

Acknowledgements

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Book reviews

Nature conservation in Sutton. Ian Yarham, Richard Barnes and Bob Britton. London Ecology Unit. Ecology Handbook No. 22. 1993. 96 pp. £4.95 at Sutton borough libraries and local bookshops, etc., or at £6.20 post free from the LEU, Bedford House, 125 Camden High Street, London NW1 7JR. ISBN 1 871045 19 3.

Nature conservation in Camden. Michael Waite, David Keech and Meg Game. London Ecology Unit. Ecology Handbook No. 24. 1993. 82 pp. £4.95 at bookshops, or £6.20 post free from the LEU. ISBN 1 871045 21 5.

These two publications are the latest in a continuing series of handbooks covering the London boroughs, more than half of which have now been described. Those discussed here are very different in character; Camden is one of the largest of the inner-London boroughs and, apart from Hampstead Heath and its surroundings, is densely urban in character. Sutton, by contrast, lies on London's southern extremity and still retains some truly rural features.

As in other recent handbooks, the first two chapters are concerned with the landscape and geology of each borough and the local history that lies behind it. In the third chapter, the range and distribution of wildlife habitats are discussed and some striking differences become apparent. Camden is particularly 'top-heavy', with Hampstead Heath dominating in the north. Sutton contains some of the best chalk grasslands in London and the River Wandle provides one of the richest chalk streams in the capital — habitats sadly absent from Camden! Two further chapters describe the roles of the council and the local voluntary organizations in promoting nature conservation. Both councils give a high priority to encouraging local schools to establish 'nature areas' within their grounds and detailed accounts are given of the successful 'greening' of selected schools. In Sutton, this has been carried a step further with the initiation in 1988 of an annual 'wildlife garden' competition. This is a pioneering project which could well be emulated by other London boroughs. Both councils have also been actively involved in setting up centres to promote environmental education. Camley Street Nature Park in Camden is described as 'perhaps the greatest and certainly one of the best-known triumphs of modern urban habitat creation in Britain' and few would argue with this assessment. Sutton's equivalent initiative is their excellent Ecology Centre opened by David Bellamy in 1989. This now attracts up to 20,000 visitors each year and has established an enviable reputation. Both centres have been declared Local Nature Reserves and are described in detail in the handbooks.

The second, and largest, part of each handbook describes the range of individual sites of nature conservation importance occurring in the boroughs. These are arranged in the now familiar hierarchy devised by the LEU, which grades the sites into three categories according to whether they are considered of Metropolitan, Borough or merely Local Importance. Hampstead Heath is, as expected, given extensive coverage in the Camden volume and it is good to see the work of several LNHS members mentioned. The recent remarkable discovery of a colony of white-letter hairstreak butterflies on the Heath was, however, too late for inclusion. A second familiar metropolitan site in Camden is Highgate Cemetery, which is illustrated here by John Gay's striking black-and-white photographs. I hope that the wall brown butterflies continue to flourish here as they appear to be rapidly declining in north London. In Sutton, the River Wandle is given detailed treatment, as are the chalk grasslands of Roundshaw Downs, which occupy the southern part of the former Croydon Airport. There are fine colour photographs of two rare London plants found here — the tall broomrape *Orobanché elatior* and the greater yellow rattle *Rhinanthus angustifolius*. Indeed, the photographs in both handbooks are of a uniformly high quality and add much to the pleasure of browsing.

The handbooks end with extensive references and further reading and a selection of relevant organizations and their addresses. The LNHS is included in both, but not our telephone number. A final appendix lists the Latin names of the plants mentioned in the text and a useful list of alternative English names.

These two handbooks give a comprehensive account of the nature conservation interest of the boroughs concerned. They should be of value, not only to naturalists living within the boroughs described, but to all those concerned with nature conservation in London as a whole. I enjoyed reading them, both for jogging memories of familiar sites and for introducing new ones to explore.

DAVID BEVAN

The flora of Hyde Park and Kensington Gardens, 1988–1993

ELINOR WILTSHIRE

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Here at my feet what wonders pass,
What endless active life is here!
What blowing daisies, fragrant grass!
An air-stirr'd forest, fresh and clear.

Matthew Arnold: *Lines written in Kensington Gardens*, 1852

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Summary

Hyde Park and Kensington Gardens have a uniquely documented botanical history. Apart from occasional records from the mid seventeenth century onwards, three detailed studies of the naturally-occurring flora of the area have been published. The first was by Warren (1871, with additions in 1875), the second by Kent (1950) and the third by Allen (1965). The observations recorded in the present paper were made intermittently over the six seasons 1988–93. Comparisons with the previous surveys are noted, indicating survivals, losses, introductions, transient appearances and other changes over the past 123 years. Mosses and liverworts are listed for the first time.

Throughout the text, the combined Hyde Park and Kensington Gardens are referred to as the ‘park’.

The development of the park

The generous expanse of grass, trees, water and flowers of this great park, so close to the heart of London, first began to take shape in 1536, when Henry VIII appropriated it as a hunting-ground from the monks of Westminster Abbey. Later it was used for military parades and royal festivities, and then under the Stuarts it was opened to the public and became a popular venue for fashionable events. In 1689 William III bought a mansion at the western end, which was altered by Sir Christopher Wren to become Kensington Palace. William and Mary, then Anne, but especially Caroline, wife of George II, extended the royal gardens until they occupied nearly half of the park area. The artificial lake, known as The Serpentine in Hyde Park and The Long Water in Kensington Gardens, was created about 1730, replacing a series of ponds along the valley of the small River Westbourne.

On the death of George II in 1760 his successor bought Buckingham Palace, and with the removal of the court, Kensington Palace diminished in importance. Although it was Victoria’s birthplace and home, she left it in 1837 as soon as she became queen. By degrees the royal gardens developed into a public pleasure ground, but they retain

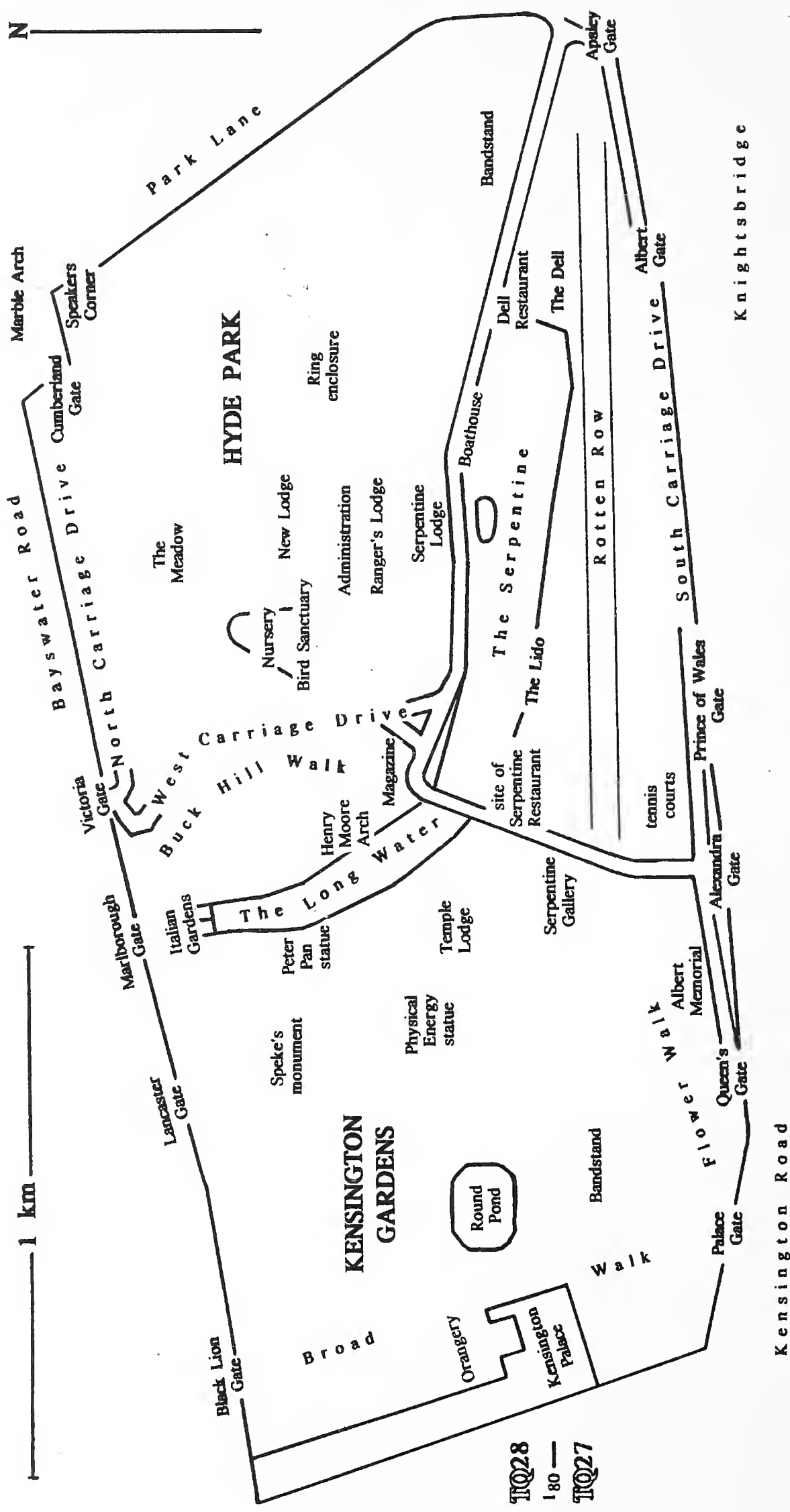


FIG. 1. Hyde Park and Kensington Gardens.

to this day a quiet and orderly character, in contrast to the crowds, activities and traffic of Hyde Park.

The area of the park as a whole (Figure 1) is 251 hectares, of which Hyde Park occupies 140 and Kensington Gardens 111, and forms an irregular rectangle, about 2½ kilometres from end to end and one kilometre across. It lies on Taplow Gravels with bands of London Clay. Much of the superficial gravel was removed in the course of landscaping during the eighteenth and nineteenth centuries, and from time to time areas of surface soil have been drastically altered. In the winter of 1832–3, as reported by Denson (1835), thin turf was stripped from parts of Kensington Gardens and the replacement soil reseeded. The resulting crop of weeds included a few plants of gold-of-pleasure *Camelina sativa*, apparently the only record from the park of this species. Despite such upheavals it is still possible to detect here and there traces of former heathland, marked in spring by the silvery shoots of early hair-grass *Aira praecox*.

Summer growth of grass was controlled by sheep-grazing up to 1959, when a rigorous mowing regime was introduced, but since 1986 a three-hectare area near Marble Arch has been left uncut until well into summer. This has become known as 'The Meadow'. In 1993 a hectare and a half in Kensington Gardens, by the Peter Pan Statue enclosure, was also left uncut and abundant red fescue *Festuca rubra* and other grasses grew to maturity.

In the mown areas it is difficult to determine what species are underfoot, but clearly annual meadow-grass *Poa annua* is very widespread, with perennial rye-grass *Lolium perenne* where an extra hard-wearing surface is needed. However, in The Meadow an interesting variety of grasses may be seen to advantage during the flowering season (Figure 2). There are substantial patches of red fescue *Festuca rubra*, rough meadow-grass *Poa trivialis*, smooth meadow-grass *P. pratensis*, common bent *Agrostis capillaris*, meadow foxtail *Alopecurus pratensis*, and timothy *Phleum pratense*. A number of other grasses, including the alien California brome *Ceratochloa carinata*,



FIG. 2. The Meadow in summer: three hectares of tranquillity within sight of Marble Arch.

Photo: David Bevan



FIG. 3. This sweet chestnut *Castanea sativa* near the Round Pond is said to be the oldest tree in the park.

Photo: Elinor Wiltshire

may also be found here. Even the well-groomed expanses of the park in general sometimes provide random specimens which add to the range.

There are almost 7,000 trees in the park, most of them familiar species such as plane *Platanus*, lime *Tilia*, chestnut *Castanea* and *Aesculus*, walnut *Juglans*, oak *Quercus* and poplar *Populus*. There are also unusual individual specimens, such as the Caucasian wingnut *Pterocarya fraxinifolia* at The Dell, the Norway maple variety with incurved leaf-tips *Acer platanoides* forma *crispum* near Lancaster Gate, and the so-called 'headache tree' California bay *Umbellularia californica* in the Flower Walk. Maintenance of this 'forest' requires continuous renewal — soil introduced with young trees is sometimes the means whereby unusual plants are brought (however temporarily) into the park.

In Kensington Gardens there are a number of ancient sweet chestnut trees *Castanea sativa*, about 275 years old, thus dating back to Queen Caroline's improvements to the royal gardens. The oldest is said to be the one nearest to the Palace (Figure 3). Carefully preserved, some are now little more than gnarled stumps with a few sparse branches, but still somehow producing leaves, flowers and fruit.

The Serpentine covers an area of about 13 hectares and The Long Water four hectares. Although they form a continuous stretch of water the bridge represents a boundary and each part is distinct in character. The Serpentine offers public access to the water's edge almost all the way round its shores, with popular facilities for boating, bathing and fishing, as well as an abundance of waterfowl — all discouraging to growth of waterweeds. In comparison, The Long Water is a quiet backwater, although also well populated with birds. Some breed here undisturbed as the public can reach its shores at only two places.

Botanical records

The park has attracted the attention of botanists from early times, the first published record apparently being that of the herbalist Culpeper (1653), who noted plentiful parsley-piert *Aphanes arvensis* (in the aggregate sense). The physician Merrett (1666) reported sticky mouse-ear *Cerastium glomeratum* and field wood-rush *Luzula campestris*, both still present, and blinks *Montia fontana*, now extinct. In the herbarium of Johann Jakob Dillenius, from 1728 Oxford's first professor of botany, there are park specimens of creeping cinquefoil *Potentilla reptans* and autumn hawkbit *Leontodon autumnalis* (Druce and Vines 1907). But it was the publication in 1869 of Trimen and Dyer's *Flora of Middlesex* that inspired the first detailed study of the wild flora of the park. This was undertaken by J. B. Leicester Warren (later Lord de Tabley, compiler of the *Flora of Cheshire*) during June and July of 1871 (Warren 1871). His approach was practical:

'We remind the town-botanist, whom want of time and cash will not allow many country excursions, that a fair section of his native flora may be seen at his very doors, and studied without the help of a railway ticket.'

He proceeded to demonstrate this by recording 163 species, ten more being added by his friend The Revd W. W. Newbould. Together with records taken from the literature, the list which he published the same year in the *Journal of Botany* amounted to a total of about 190 species. On 25 September 1875 he and Newbould made a further search and added another eighteen. Warren omitted trees and most casuals: 'The plants of the genuine open park herbage are really the important matter in this record'. He was particularly pleased to find harebells *Campanula rotundifolia* — 'most interesting survivors'. In his survey Warren set a pattern by specifying whether a plant was in turf, flower-bed, resown area and so on, also by recording Hyde Park and Kensington Gardens separately. This has been followed by his successors.

Over seventy years were to pass before the next detailed study was undertaken. During the period from spring 1947 to autumn 1949, Douglas H. Kent made a number

of visits to the park, then still showing the effects of wartime disturbance by army camps, air-raid shelters and allotments. It seemed as though many of Warren's plants must be extinct, but there was an increase in naturalized aliens and weeds of cultivation. He recorded 136 species, a list which was published in *Watsonia* in 1950. Subsequently, Kent (1960–7) published a series of papers on the flora of central London, adding a few more park records contributed by himself, David E. Allen, Lady Anne Brewis and Brian Wurzell.

Meantime, David Allen had embarked upon a prolonged and detailed study of the park flora, with visits at least weekly throughout five summers from 1958 to 1962. The resulting comprehensive account (Allen 1965) recorded 309 species and hybrids, including some unusual casuals from major road-works along Park Lane during 1960–2. Two plants of *Plantago maritima*, found at a path edge near the bowling greens in 1959, remain the only Middlesex record for this species. His paper also gives an account of the historical background of the park and its flora, with an analysis of changes since Warren's time. Two of the most marked were the virtual disappearance of aquatics and the spread of 'new' weeds such as pineapple-weed *Matricaria discoidea*. But on the whole, comparison with Warren's and Kent's lists led him to the conclusion that 'the majority of these changes are surely more apparent than real, the result of more intensive field-work'.

Following completion of his paper, Allen continued for some time to record the park flora and he has kindly communicated to this survey particulars of several unpublished finds, as well as a couple of corrections to his published records. The additions are cowherb *Vaccaria hispanica* (1965), goat's-rue *Galega officinalis* (1964), herb robert *Geranium robertianum* (1969), ivy-leaved toadflax *Cymbalaria muralis* (1969) and a naturalized colony of Spanish bluebell *Hyacinthoides hispanica* on the east bank of The Long Water from 1969 onwards. The corrections are apple-of-Peru *Nicandra physalodes* in place of thorn-apple *Datura stramonium*, and grey sedge *Carex divulsa* in place of spiked sedge *C. spicata*.



FIG. 4. Giant butterbur *Petasites japonicus*, an introduction that has long been an attractive feature near the Italian Gardens.

Photo: Elinor Wiltshire

From 1967 to 1987 there were few published references to the park flora. John Palmer found ragweed *Ambrosia artemisiifolia*, yellow bristle-grass *Setaria pumila*, and 'other aliens' near The Serpentine in 1976 (*Lond. Nat.* **56**:89), and a casual pirri-pirri-bur *Acaena caesiiglauca* in shrubberies by The Serpentine (*BSBI News* **42**:18). In 1980 Elizabeth Norman reported giant butterbur *Petasites japonicus* in Kensington Gardens (*Lond. Nat.* **60**:93), where it persists (Figure 4).

The park flora, 1988–1993

The present study began in the summer of 1988, in the aftermath of the great storm of the previous autumn, when hundreds of the park trees had been blown down. The resulting craters had been filled in with introduced soil and, helped by the wet season, were soon brimming with weeds, some more familiar in the countryside than in this setting: field pansy *Viola arvensis*, field penny-cress *Thlaspi arvense*, scarlet pimpernel *Anagallis arvensis*, field bindweed *Convolvulus arvensis* and field forget-me-not *Myosotis arvensis*. These were especially noticeable at some infilled sites in Kensington Gardens, but died out after a year or two.

An abundance of larger weeds helped to fill such sites and any other available bare ground. These included common fumitory *Fumaria officinalis*, common poppy *Papaver rhoeas*, weld *Reseda luteola*, cut-leaved crane's-bill *Geranium dissectum*, wild carrot *Daucus carota* and wild teasel *Dipsacus fullonum*, but after a couple of seasons these patches had grassed over.

Then for a short period in 1991 the site of the demolished Serpentine Restaurant brought a new assortment of weeds. The foundations appeared to have been filled in with material from an urban source, which produced a distinctive display including tall rocket *Sisymbrium altissimum*, eastern rocket *S. orientale*, hoary mustard *Hirschfeldia incana*, white and ribbed melilot *Melilotus albus* and *M. officinalis*, common toadflax *Linaria vulgaris* and welshed thistle *Carduus crispus* ssp. *multiflorus*.

Some unexpected native species made individual appearances, for instance water chickweed *Myosoton aquaticum* at three separate sites in 1988 and 1989, and a plant of hemlock water-dropwort *Oenanthe crocata* which managed to reach substantial proportions at the Fountains during 1990. But the most remarkable was mousetail *Myosurus minimus*, found by Brian Wurzell on a scruffy patch under a poplar by North Carriage Drive in April 1990.

Other plants confirmed long-standing associations with particular locations. One of these was goat's-beard *Tragopogon pratensis*, found near Alexandra Gate and Queen's Gate, and recorded in the same area by Warren, Kent and Allen. Another was lady's bedstraw *Galium verum*, which Warren recorded 'in hay-grass east of the Palace'. Allen found a single plant near here as well as a large patch in the Orangery lawn. Despite drastic treatment by mowing it still appears from time to time in this vicinity. A further survivor is wild teasel *Dipsacus fullonum* in its tiny colony on the east side of The Long Water, noted here by Warren, Kent and Allen. In some seasons only one plant is to be seen, in others as many as twenty.

Some of the most elusive plants in the park are to be found occasionally among expanses of grass, where they are small enough to survive mowing, in however stunted a form. These include dove's-foot crane's-bill *Geranium molle*, the rarer small-flowered crane's-bill *G. pusillum*, and common stork's-bill *Erodium cicutarium* (which is very scarce in the park). More conspicuous in secluded grassy areas are lesser stitchwort *Stellaria graminea*, creeping cinquefoil *Potentilla reptans*, common bird's-foot trefoil *Lotus corniculatus* and self-heal *Prunella vulgaris*.

Wet conditions during the summer of 1988 brought to the surface a few plants of marsh dock *Rumex palustris*, not previously recorded in the park, but much more

surprising was the appearance the following year of a small colony of fiddle dock *Rumex pulcher*. This appeared in slightly uneven ground beside Buck Hill Walk, which lies between Buck Hill Lodge near Victoria Gate and the Magazine. It marks part of the old boundary of the royal gardens and formerly consisted of a wall concealed in a ditch (a scenic device known as a ha-ha). The ditch was still there in Warren's day, and in it he found fool's water-cress *Apium nodiflorum*, water-pepper *Polygonum hydropiper* and brooklime *Veronica beccabunga*, though not nodding bur-marigold *Bidens cernua* or greater dodder *Cuscuta europaea* which had previously been recorded there. Eventually the ditch was filled in and replaced by the present-day 'walk', but perhaps the fiddle dock is a relic of this once-flourishing community.

The Serpentine and the Round Pond have held a particular interest for botanists because of the range of aquatic plants to be found in their waters. Fennel pondweed *Potamogeton pectinatus* was recorded in The Serpentine by William Hudson (1762) and by Thomas Martyn (1763). Warren found it in The Long Water together with curled pondweed *P. crispus* and lesser pondweed *P. pusillus*, but by Kent's time all three were confined to the Round Pond and to what were then lily ponds at the Italian Gardens. Allen found the last two in the Round Pond with *Zannichellia palustris*, but considered The Serpentine to be barren. However Lee (1977), in the course of a study of Serpentine fish during 1971, reported that although 'the flora of the lake was not abundant ... perhaps due to grazing by the numerous ducks', *Elodea* spp. and *Potamogeton* sp. were found around the shoreline. Canadian waterweed *Elodea canadensis* and fennel pondweed *Potamogeton pectinatus* persist in The Long Water, the latter to such an extent that in the mid 1980s it had to be controlled with herbicide. There does not appear to be any vegetation in the Round Pond.

The Long Water has been newly edged with an almost continuous wooden revetment, which will probably make it difficult for waterside plants to establish themselves.

Species which are members of the British wild flora, but which in the park were deliberately introduced, have not been included in the list that follows. Of these probably the oldest is chamomile *Chamaemelum nobile*, some patches of which survive in the lawn fronting Kensington Palace. In 1989 the edge of one was within reach of a public path, but the railings were later moved outwards. A few years ago meadowsweet *Filipendula ulmaria*, hemp-agrimony *Eupatorium cannabinum* and oxeye daisies *Leucanthemum vulgare* were planted in a small enclosure by Black Lion Gate, as an experiment to add variety to the formality of the park.

This new approach was taken a step further when, during the winter of 1988–9, an assortment of native species was planted in The Meadow. These included:

| | |
|--|---|
| <i>Silene vulgaris</i> bladder campion | <i>Silaum silaus</i> pepper-saxifrage |
| <i>Hypericum pulchrum</i> slender St John's-wort | <i>Stachys officinalis</i> betony |
| <i>Primula veris</i> cowslip | <i>Salvia verbenaca</i> wild clary |
| <i>Saxifraga granulata</i> meadow saxifrage | <i>Rhinanthus minor</i> yellow-rattle |
| <i>Sanguisorba minor</i> salad burnet | <i>Campanula glomerata</i> clustered bellflower |
| <i>Lathyrus nissolia</i> grass vetchling | <i>C. rotundifolia</i> harebell |
| <i>Trifolium ochroleucon</i> sulphur clover | <i>Fritillaria meleagris</i> fritillary |

Of these only *Silene vulgaris* and *Campanula rotundifolia* have been recorded previously in the park, although Merrett (1666) reported *Lathyrus nissolia* at Tyburn (Marble Arch). They are therefore distinct from the natural park flora and their survival is uncertain, but meantime The Meadow is a feature of pleasure and interest. In particular the sulphur clover *Trifolium ochroleucon* offers London botanists a chance to see a rarity. Oxeye daisies *Leucanthemum vulgare* and common knapweed *Centaurea nigra* were also planted here and are flourishing.

During 1993 bluebells *Hyacinthoides* sp. and a single plant of meadowsweet *Filipendula ulmaria* were observed in grass just south of The Meadow, apparently associated with the garden of nearby New Lodge (Timothy Freed pers. comm.)

Conclusions

In the course of this study, 287 species or subspecies of naturally-occurring vascular plants were recorded. Of these 282 are in Stace (1991) and five are aliens not in Stace. The latter are:

Nigella sativa L. Grown for its aromatic seeds — related to love-in-a-mist *N. damascena*.

Aesculus indica (Colebr. ex Cambess.). Indian horse-chestnut.

Heliotropium europaeum L. A member of the borage family.

Helianthus rigidus (Cass.) Desf. A North American sunflower.

Arthraxon hispidus (Thunb.) Makino. An Indian grass.

The total comprises four species of fern, three of sedges, three of rushes, 40 of grasses, 10 of seedling trees and shrubs, and 227 of other flowering plants. Of the last mentioned about 160 appear to be basic to the park flora, while the remainder (roughly 25 per cent) are transitory, many being weeds common to waste ground throughout London and soon eradicated. As Kent and Allen had found, major alterations to the fabric of the park could bring a surge of unusual records — perhaps never to be repeated once grass had grown over the wounds. During the period of this study the effects of the 1987 storm and of the demolition of the Serpentine Restaurant made conspicuous but short-lived contributions. Adulterated grass-seed brought narrow-leaved hawk's-beard *Crepis tectorum*, a new Middlesex record, which flourished for a couple of seasons before succumbing to the mower. Another Middlesex record was provided by the hairless blue sow-thistle *Cicerbita plumieri*, a native of the mountains of central Europe, which appeared mysteriously in a post-flowering daffodil patch near The Dell. Picnics or bird-seed were responsible for the presence of various exotics, among them the semi-tropical grass *Arthraxon hispidus*, the first British record.

Weather variations caused some unusual appearances. A wet season brought the emergence of the marsh dock *Rumex palustris*, and the dry summer of 1990 saw the return of skullcap *Scutellaria galericulata* to the lowered waters of The Serpentine. According to the *Flora of Middlesex* there was a Kensington Gardens specimen of this plant in Goodger and Rozea's herbarium in 1817, but there are no subsequent records.

The most obvious new arrivals are species which are well-known to be spreading through London and beyond — hoary cress *Lepidium draba*, hoary mustard *Hirschfeldia incana*, Guernsey fleabane *Conyza sumatrensis*, and California brome *Ceratochloa carinata*.

Among the long-established flora of the park it was satisfying to find that some modest communities, for instance of lady's bedstraw *Galium verum* and of wild teasel *Dipsacus fullonum*, had managed to survive in the same sites since Warren's time.

A few important 1994 additions to the park flora have been included in the following list. The most striking is perennial rocket *Sisymbrium strictissimum*, a rare casual from central Europe, in recent decades represented in the London Area by a single long-naturalized colony in Kew churchyard. A few flowering heads were observed by Brian Wurzell in the shrubbery surrounding the Nursery area. By kind permission of the park authorities the Nursery enclosure was then visited, and a fine plant of perennial rocket was found inside the boundary wall.

This visit also revealed specimens of pale willowherb *Epilobium roseum*, *E. roseum* × *E. ciliatum* and the alien grass, water bent *Polypogon viridis*, as well as a plant of sticky groundsel *Senecio viscosus*.

In general, comparison with the previous surveys leads to the conclusion that it is not possible to define specific botanical trends in the park — there are too many random and ever-changing factors. But one thing is certain: it can produce surprises. In all, some 450 species have been recorded here since the mid seventeenth century — and no doubt there are more to come.

LIST OF SPECIES

Arrangement and nomenclature of vascular plants are in accordance with Stace (1991), and of bryophytes with Hill et al. (1991–4).

With the exception of items communicated by the park authorities, the following list is a personal record of species seen during the period of this study. For comparison, species already recorded by Warren (1871, 1875), Kent (1950) and Allen (1965) are indicated by the initials W, K, A, in the left-hand margins. Subsequent records, whether published or personally communicated, are acknowledged in the text.

H = Hyde Park, **K** = Kensington Gardens.

Very common species are listed without comment.

VASCULAR PLANTS

DENNSTAEDTIACEAE

- W A *Pteridium aquilinum* bracken. **H** – in shrubby bed S of Dell, August 1990. **K** – in shrubby bed in front of Magazine, July 1988; persistent in area at rear of Loggia at Italian Gardens.

ASPLENIACEAE

- Phyllitis scolopendrium* hart's-tongue fern. **H** – in shrubby bed SE of bridge, February 1990. **K** – persistent on terrace wall (probably planted) and in area at rear of Loggia at Italian Gardens.

DRYOPTERIDACEAE

- A *Dryopteris filix-mas* male-fern. **H** – rear of Serpentine Lodge and in damaged bollard at Victoria Gate, February 1990.
D. dilatata broad buckler-fern. **K** – edge of rhododendron beds by Flower Walk, February 1990 (det. J. M. Mullin) and persisting.

RANUNCULACEAE

- Nigella sativa* L. **K** – behind bench at rear of Albert Memorial, June 1989 (det. J. M. Mullin).
WKA *Ranunculus acris* meadow buttercup. **H** – occasional — vulnerable to mowing.
WKA *R. repens* creeping buttercup.
W A *R. bulbosus* bulbous buttercup. Extensive patches throughout.
W A *R. sceleratus* celery-leaved buttercup. **H** – by Serpentine NE of bridge (Warren's and Allen's site), June 1989. **K** – infill sites and by Temple Lodge, July 1988; 2 plants by Long Water near Peter Pan Statue, August 1990.
WK *R. ficaria* lesser celandine. **H** – a scattered colony of ssp. *ficaria* along Park Lane railings (c. 100 flowers), and a few plants among daffodils towards Knightsbridge, April 1990. **K** – several plants on introduced soil during alterations to Kensington Palace railings, March 1990.
Myosurus minimus mousetail. **H** – on barish patch under poplar near North Carriage Drive, April 1990 (B. Wurzell).

PAPAVERACEAE

- A *Papaver somniferum* opium poppy. Occasional.
A *P. rhoeas* common poppy. Occasional on disturbed ground.

FUMARIACEAE

- Fumaria muralis* ssp. *boraei* common ramping-fumitory. **K** – infill N of Albert Memorial, July 1989 (det. J. M. Mullin).
A *F. officinalis* common fumitory. **K** – on introduced soil, June 1988.

PLATANACEAE

- Platanus* × *hispanica* London plane. **K** – seedlings on steps of Albert Memorial, July 1989.

URTICACEAE

- WKA *Urtica dioica* common nettle.
 WKA *U. urens* annual nettle. **HK** – frequent.

FAGACEAE

Quercus cerris Turkey oak. **K** – seedlings at tree bases from buried acorns.

CHENOPODIACEAE

- WKA *Chenopodium rubrum* red goosefoot. **H** – occasional along margin of Serpentine, August 1990. **K** – on introduced soil, August 1988; 2 plants by Long Water near Peter Pan Statue, August 1990.
- W A *C. polyspermum* many-seeded goosefoot. **H** – in bed near tennis courts and in bed NE of bridge, July 1989. **K** – in bare patches N of Flower Walk, September 1989.
- KA *C. ficifolium* fig-leaved goosefoot. **K** – infill near Physical Energy Statue, June 1989 (det. J. M. Mullin).
- WKA *C. album* fat-hen.
- Bassia scoparia* summer-cypress. **K** – 2 plants by railings at Marlborough Gate, August 1990.
- Spinacia oleracea* spinach. **H** – 1 plant by railings near Dell, August 1990.
- KA *Atriplex prostrata* spear-leaved orache. Frequent on disturbed ground.
- W A *A. patula* common orache. Occasional on disturbed ground.

AMARANTHACEAE

Amaranthus retroflexus common amaranth. **H** – 1 plant by railings towards Park Lane, August 1989. **K** – 2 plants by railings at Marlborough Gate, 1 plant near Italian Gardens and 1 plant near Buck Hill Lodge, September 1989; similar appearances in subsequent years.

PORTULACACEAE

Claytonia perfoliata springbeauty. **H** – 1 plant on path by Bird Sanctuary, June 1993 (D. H. Kent and J. M. Mullin); several plants in Nursery enclosure, June 1994.

CARYOPHYLLACEAE

- WKA *Stellaria media* common chickweed.
- W A *S. graminea* lesser stitchwort. Plentiful in some secluded lawn areas. **H** – rear of Cumberland Lodge, Marble Arch, June 1989. **K** – lawn by Serpentine Gallery, June 1989; in enclosure by Black Lion Gate and by Henry Moore Arch, June 1993.
- WKA *Cerastium fontanum* common mouse-ear.
- W *C. glomeratum* sticky mouse-ear. First recorded in the park by Christopher Merrett, 1666 — occasional patches throughout in short grass. **H** – path edge towards Park Lane, June 1989; under trees S of Dell, April 1990. **K** – by Lancaster Gate, June 1990, May 1993.
- Myosoton aquaticum* water chickweed. **H** – 1 plant at rear of Serpentine Lodge, August 1989. **K** – 1 plant at base of young tree by North Walk and plant by Temple Lodge, September 1988.
- WKA *Sagina procumbens* procumbent pearlwort. **K** – Italian Gardens, August 1988; Henry Moore Arch, May 1993.
- S. apetala* ssp. *erecta* annual pearlwort. **H** – by tennis courts, May 1993. **K** – path edge by Marlborough Gate, May 1993 (det. R. M. Burton).
- KA *Silene latifolia* ssp. *alba* white campion. **H** – 2 plants at W end of Rotten Row, June 1989. **K** – 1 plant in rough patch N of Flower Walk, July 1989.
- WKA *S. dioica* red campion. **K** – 1 plant in bare patch N of Albert Memorial, June 1989.

POLYGONACEAE

- WKA *Persicaria maculosa* redshank. Common in disturbed ground.
- WKA *P. lapathifolia* pale persicaria. Fairly common in disturbed ground.

- A *Polygonum arenastrum* equal-leaved knotgrass. Common on path verges and waste ground.
- WKA *P. aviculare* knotgrass. As above.
- A *Fallopia japonica* Japanese knotweed. **K** – on banks of The Long Water.
- WKA *F. convolvulus* black-bindweed. **H** – 1 plant by rose garden near Hyde Park Corner, August 1989. **K** – infills, August 1988.
- WKA *Rumex acetosella* sheep's sorrel. **H** – in Meadow and by tennis courts, August 1988; towards Park Lane, June 1989. **K** – infills, July 1988; lawn E of Kensington Palace, July 1993.
- W A *R. acetosa* common sorrel. **H** – by Victoria Gate, June 1989. **K** – infills, July 1988.
- R. patientia* patience dock. **H** – 1 plant (which grew to 1 metre before mowing) on grassy bank by Knightsbridge, April 1990 (det. J. M. Mullin).
- WKA *R. crispus* curled dock. **H** – occasional in rough grass.
- R. conglomeratus* clustered dock. **H** – infill, 1988.
- W A *R. sanguineus* wood dock. **H** – occasional in rough grass.
- R. pulcher* fiddle dock. **K** – several plants in small patch of old turf N of Magazine, August 1989 (det. J. M. Mullin).
- WKA *R. obtusifolius* broad-leaved dock. Common in rough grass and disturbed ground.
- R. palustris* marsh dock. **H** – 3 plants near pump E of Nursery and 1 plant under trees E of Magazine, July 1988.

MALVACEAE

- W A *Malva sylvestris* common mallow. Common in rough grass and bare patches.
- A *M. neglecta* dwarf mallow. **H** – vigorous plants in reseeded patch (bonfire site) E of Ring enclosure, August 1988 — a few still there in 1989; in lawn opposite the Bandstand, September 1990.

VIOLACEAE

- A *Viola arvensis* field pansy. **K** – infills, July 1988 — a few reappeared in 1989.

CUCURBITACEAE

- Bryonia dioica* white bryony. **K** – in weedy patch near Italian Gardens, June 1993 (D. H. Kent and J. M. Mullin).

SALICACEAE

- Populus* sp. poplar. **H** – seedling near Victoria Gate, June 1989.

BRASSICACEAE

- Sisymbrium strictissimum* perennial rocket. **H** – in a shrubbery surrounding Nursery enclosure, June 1994 (B. Wurzell).
- A *S. altissimum* tall rocket. **H** – 2 plants on site of demolished Serpentine Restaurant, July 1991.
- A *S. orientale* eastern rocket. **H** – 1 plant in bare patch W of Speakers Corner, August 1989; plentiful on site of Serpentine Restaurant, July 1991; a number of plants along path edge S of the Bandstand, July 1993.
- WKA *S. officinale* hedge mustard.
- Descurainia sophia* flixweed. **K** – 1 plant by railings near Serpentine Gallery, June 1989.
- Alliaria petiolata* garlic mustard. **H** – 1 plant in rough grass E of Dell and 2 plants in disturbed strip by Rotten Row, April 1990.
- A *Arabidopsis thaliana* thale cress. Common in flower-beds. **H** – under trees S of Dell, April 1990. **K** – in bed by Peter Pan Statue, September 1988.
- WKA *Erysimum cheiranthoides* treacle mustard. **H** – on site of Serpentine Restaurant, July 1991. **K** – 1 plant in bed by Magazine, September 1988.
- A *Barbarea vulgaris* winter-cress. **H** – 1 plant at base of young tree N of Dell, September 1988.

- W *Rorippa nasturtium-aquaticum* water-cress. **H** – by pond in New Lodge garden (The Royal Parks Agency).
R. palustris marsh yellow-cress. **H** – weed inside Nursery enclosure.
- KA *R. sylvestris* creeping yellow-cress. **K** – 1 plant in weedy patch by Italian Gardens, June 1993.
- K *Cardamine flexuosa* wavy bitter-cress. **H** – by tennis courts (det. D. H. Kent), June 1989.
K – in bed E of Albert Memorial, June 1989; on bank SW of bridge, July 1989.
- A *C. hirsuta* hairy bitter-cress. **K** – in bed E of Albert Memorial, June 1989.
- WKA *Capsella bursa-pastoris* shepherd's-purse.
- W *Thlaspi arvense* field penny-cress. **K** – infills, July 1988; bare patch E of Round Pond, June 1989; several plants in new soil near Victoria Gate, May 1990 (Allen 1964, in Kent (1967)).
- Lepidium sativum* garden cress. **K** – behind bench by Albert Memorial, by railings near Marlborough Gate, June 1989, and other casual appearances — of birdseed or sandwich origin.
- L. draba* hoary cress. **H** – 3 plants in disturbed ground S of Marble Arch, October 1988; sporadic in disturbed strip by Rotten Row, 1988, and persistent in rough ground N of tennis courts; 2 plants S of Marble Arch, July 1989. **K** – 1 plant by Broad Walk, September 1988; 2 plants by Victoria Gate, May 1990.
- WKA *Coronopus squamatus* swine-cress. Common on paths and in bare patches.
- WKA *C. didymus* lesser swine-cress. Common on paths and in bare patches.
- Diplotaxis tenuifolia* perennial wall-rocket. **H** – 3 plants on site of Serpentine Restaurant, September 1991 (Allen 1965, in Kent (1967)).
- D. muralis* annual wall-rocket. **K** – infills, July 1988.
- Brassica napus* rape. Sporadic in disturbed soil.
- A *B. rapa* turnip. Sporadic in disturbed soil.
- WKA *Sinapis arvensis* charlock. Common on disturbed ground.
- Hirschfeldia incana* hoary mustard. **H** – numerous plants on site of Serpentine Restaurant, July 1991 — first appearance in park? **K** – 4 plants in weedy patch near Queen's Gate, July 1993.
- Rapistrum rugosum* bastard cabbage. **K** – 1 plant in weedy patch by Italian Gardens, September 1991.
- A *Raphanus raphanistrum* wild radish. Sporadic in disturbed ground. **H** – in disturbed strip by Rotten Row, July 1988. **K** – infills, July 1988.

RESEDACEAE

- A *Reseda luteola* weld. Infills and disturbed ground July 1988.

PRIMULACEAE

- W A *Angallis arvensis* ssp. *arvensis* scarlet pimpernel. **K** – infilled sites, August 1988; 1 plant (blue form) in weedy patch by Italian Gardens, June 1993.

ROSACEAE

- A *Rubus cissburiensis* bramble. **H** – in Nursery enclosure. **K** – in Magazine enclosure; on E bank of The Long Water (D. E. Allen).
- A *R. armeniacus* bramble. **H** – in Nursery enclosure. **K** – on E bank of The Long Water (D. E. Allen).
- R. surrejanus* bramble. **H** – 1 bush in Nursery enclosure, June 1993 (D. E. Allen).
- R. caesius* dewberry. **H** – under bushes beside grassy bank by Knightsbridge, June 1989 (D. E. Allen).
- Filipendula ulmaria* meadowsweet. **H** – 1 plant in grass S of The Meadow, May 1993 (T. Freed pers. comm.).
- A *Potentilla anserina* silverweed. Occasional in grass, especially in damp seasons.
- WKA *P. reptans* creeping cinquefoil. Occasional in secluded grassy areas.

- A *Geum urbanum* wood avens. **K** – 1 plant on steps of Serpentine Gallery, August 1990; several on E bank of The Long Water, June 1993.
- A *Aphanes inexpectata* slender parsley-piert. **H** – under poplar near North Carriage Drive (*Myosurus minimus* site), May 1992 (D. Bevan). **K** – abundant N of Round Pond.
- Rosa canina* dog-rose. **H** – a bush in tennis courts fencing, in flower, June 1993.
- Sorbus aucuparia* rowan. **K** – 2 seedlings N of Round Pond, July 1989.

FABACEAE

- Galega officinalis* goat's-rue. **H** – a few plants, both lilac and white flowered, on site of Serpentine Restaurant, July 1991 (Allen 1964 pers. comm.).
- W A *Lotus corniculatus* common bird's-foot-trefoil. In secluded lawn areas.
- W A *Vicia hirsuta* hairy tare. **K** – infilled patches, July 1988.
- WKA *V. sativa* ssp. *nigra* common vetch. **H** – bank overlooking Knightsbridge, June 1989; opposite Bandstand, June 1990.
- K *Melilotus albus* white melilot. **H** – on site of Serpentine Restaurant, September 1991.
- WKA *M. officinalis* ribbed melilot. **H** – on site of Serpentine Restaurant, July 1991.
- WKA *Medicago lupulina* black medick. Occasional in thin sward.
- A *M. arabica* spotted medick. **K** – patch in 'meadow' S of Peter Pan Statue.
- WKA *Trifolium repens* white clover.
- K *T. hybridum* alsike clover. Sporadic, especially along grass verges.
- WKA *T. dubium* lesser trefoil. Abundant.
- W A *T. micranthum* slender trefoil. **K** – in front of Queen Victoria Statue by Kensington Palace; in 'meadow' S of Peter Pan Statue.
- WKA *T. pratense* red clover.

ONAGRACEAE

- KA *Epilobium hirsutum* great willowherb. Occasional.
- KA *E. parviflorum* hoary willowherb. **K** – in bed S of Serpentine Gallery, June 1989.
- WKA *E. montanum* broad-leaved willowherb. **K** – infills, July 1988; by Marlborough Gate, May 1993.
- KA *E. ciliatum* American willowherb. **H** – in shrubbery towards Knightsbridge, July 1989. **K** – in bed S of Serpentine Gallery, June 1989.
- W *E. tetragonum* square-stalked willowherb. **H** – in shrubbery towards Knightsbridge, July 1989, May 1993. **K** – by Peter Pan Statue, June 1991.
- WKA *E. roseum* pale willowherb. **H** – in Nursery enclosure, June 1994 (det. B. Wurzell).
- E. roseum* × *E. ciliatum*. **H** – in Nursery enclosure, June 1994 (det. B. Wurzell).
- KA *Chamerion angustifolium* rosebay willowherb. Occasional. **K** – in hedge by Bayswater Road, July 1988.
- A *Oenothera biennis* common evening primrose. **K** – in weedy patch by Italian Gardens, July 1988.
- WKA *Circaea lutetiana* enchanter's nightshade. Common in beds and shrubberies.

EUPHORBIACEAE

- A *Mercurialis annua* annual mercury. A common weed. **H** – in Ring enclosure, July 1988. **K** – at Marlborough Gate, July 1988.
- W A *Euphorbia helioscopia* sun spurge. **H** – 4 plants in disturbed ground (bonfire site) E of Ring enclosure, July 1989; 2 plants at same site, April 1990.
- W A *E. peplus* petty spurge.

LINACEAE

- A *Linum usitatissimum* flax. Occasional single plants of birdseed origin. **H** – 1 plant near Serpentine NE of bridge, June 1989. **K** – 1 plant by Orangery, September 1988; 1 plant at base of young tree near Lancaster Gate, October 1988.

HIPPOCASTANACEAE

Aesculus indica (Colebr. ex Cambess.) Hook. Indian horse-chestnut. **K** – abundant seedlings each season under a tree by S end of Broad Walk.

ACERACEAE

Acer pseudoplatanus sycamore. **K** – seedlings common near Marlborough Gate.

SIMAROUBACEAE

Ailanthus altissima tree-of-heaven. **K** – seedlings by Albert Memorial, June 1989.

OXALIDACEAE

Oxalis corniculata procumbent yellow-sorrel. **K** – along wall near Marlborough Gate, May 1993; on peat blocks by Flower Walk, July 1993.

O. exilis least yellow-sorrel. **K** – in grass at rear of Albert Memorial, July 1989.

A *O. debilis* var. *corymbosa* large-flowered pink-sorrel. **H** – 1 plant on site of Serpentine Restaurant, July 1991. **K** – on peat blocks by Flower Walk, July 1993.

GERANIACEAE

WK *Geranium dissectum* cut-leaved cranesbill. Fairly common in disturbed ground. **H** – infill sites, July 1988; at base of young tree towards Park Lane and near Victoria Gate, September 1988; in Meadow and in lawn opposite Bandstand, May 1993. **K** – infill sites, July 1988.

G. pyrenaicum hedgerow cranesbill. **H** – 1 plant near Victoria Gate, May 1991.

W *G. pusillum* small-flowered cranesbill. Very occasional among grass or at verges. **H** – near Bandstand, September 1988; near Victoria Gate and by path in Ring enclosure, June 1989; in grass S of Ring, August 1989. **K** – 1 plant N of Magazine, August 1990; by railings near Victoria Gate, May 1993 (also recorded by B. Wurzell in Kent (1960)).

W A *G. molle* dove's-foot cranesbill. Occasional among grass and on barish patches. In Kensington Gardens there are colonies of the pale variety W of the Albert Memorial, E of Kensington Palace and W of Orangery.

Erodium cicutarium common storksbill. Rare. **H** – on bank overlooking Knightsbridge, July 1988; in grass W of Ring, June 1989.

ARALIACEAE

A *Hedera helix* ivy.

APIACEAE

KA *Anthriscus sylvestris* cow parsley. Occasional. **H** – lawn opposite Bandstand, April 1990. **K** – infill sites, July 1988; under trees near Marlborough Gate, May 1993 (a large colony was noted by Allen in this area).

W A *Conopodium majus* pignut. **K** – under trees near Marlborough Gate, May 1993.

A *Aegopodium podagraria* ground-elder. **K** – infill sites, July 1988.

Oenanthe crocata hemlock water-dropwort. **K** – large plant at Italian Gardens, on damp steps overlooking The Long Water, May 1990.

WKA *Aethusa cynapium* fool's parsley. Common in disturbed ground. **H** – in Ring enclosure, July 1988. **K** – N of Flower Walk, August 1988.

A *Conium maculatum* hemlock. Sporadic. **H** – in Meadow, August 1991. **K** – by Temple Lodge, July 1988.

Petroselinum crispum garden parsley. **H** – 1 plant by railings near Dell, August 1990 (with spinach). **K** – a colony by Marlborough Gate, July 1991.

A *Pastinaca sativa* parsnip. **K** – 1 plant by Henry Moore Arch and 1 plant SW of bridge, July 1989.

KA *Heracleum sphondylium* hogweed. **H** – in Ring enclosure, July 1988. **K** – by Long Water, July 1988.

KA *H. mantegazzianum* giant hogweed. **K** – by The Long Water — at times a spectacular feature (Figure 5).

Torilis japonica upright hedge-parsley. **H** – 1 plant in disturbed strip by Rotten Row, July 1988 (Kent 1960).

Daucus carota wild carrot. **K** – infill sites, July 1988.

SOLANACEAE

A *Lycopersicon esculentum* tomato. Occasionally germinates at picnic sites.

WKA *Solanum dulcamara* bittersweet. A common weed.

CONVOLVULACEAE

W A *Convolvulus arvensis* field bindweed. **K** – infill sites, July 1988.

W A *Calystegia sepium* hedge bindweed. **H** – in bed SE of bridge, July 1989; in hedge by Dell Restaurant, August 1989. **K** – 1 plant by Peter Pan Statue, June 1989.

K *C. silvatica* large bindweed. **H** – covering wall at Ring, June 1989. **K** – covering wall of Queen Anne's Seat at Italian Gardens, June 1993.

BORAGINACEAE

Heliotropium europaeum L. **H** – under railings by tennis courts, June 1989.

W *Myosotis scorpioides* water forget-me-not. **H** – by pond in New Lodge garden (The Royal Parks Agency).

W *M. arvensis* field forget-me-not. **H** – infill sites, 1988; a persistent small colony by railings near tennis courts; on disturbed ground by North Ride, July 1989. **K** – infill sites, 1988.

LAMIACEAE

WKA *Stachys sylvatica* hedge woundwort. **H** – 1 plant near Victoria Gate, July 1989. **K** – several plants on slope SW of bridge, July 1989.

A *Ballota nigra* black horehound. **H** – on bank overlooking Knightsbridge, June 1989. **K** – by railings near Black Lion Gate, numerous plants at bases of newly-planted trees near Lancaster Gate, June 1989.

A *Lamium album* white dead-nettle. Fairly common on disturbed ground.

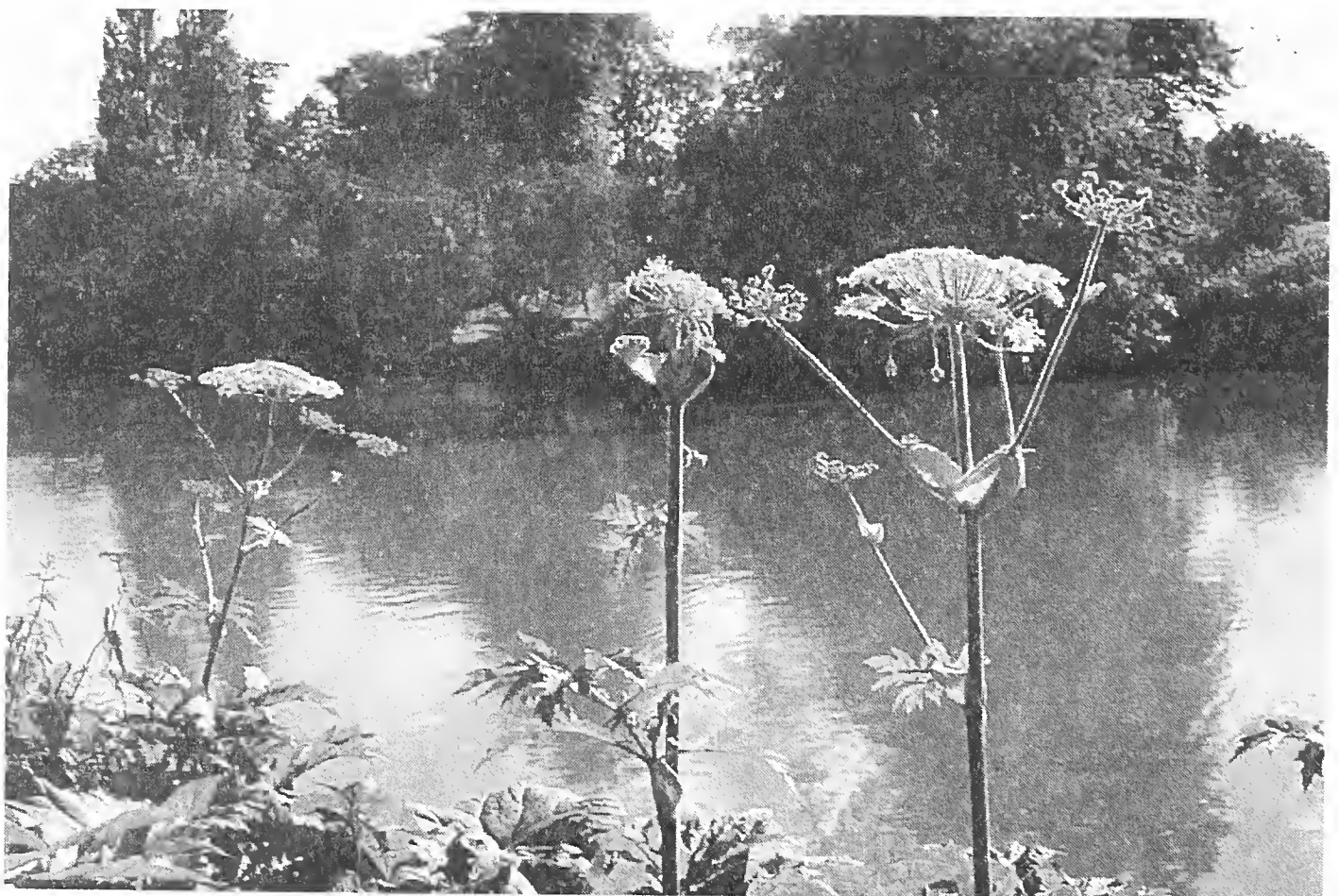


FIG. 5. Giant hogweed *Heracleum mantegazzianum* by The Long Water. Photo: Elinor Wiltshire

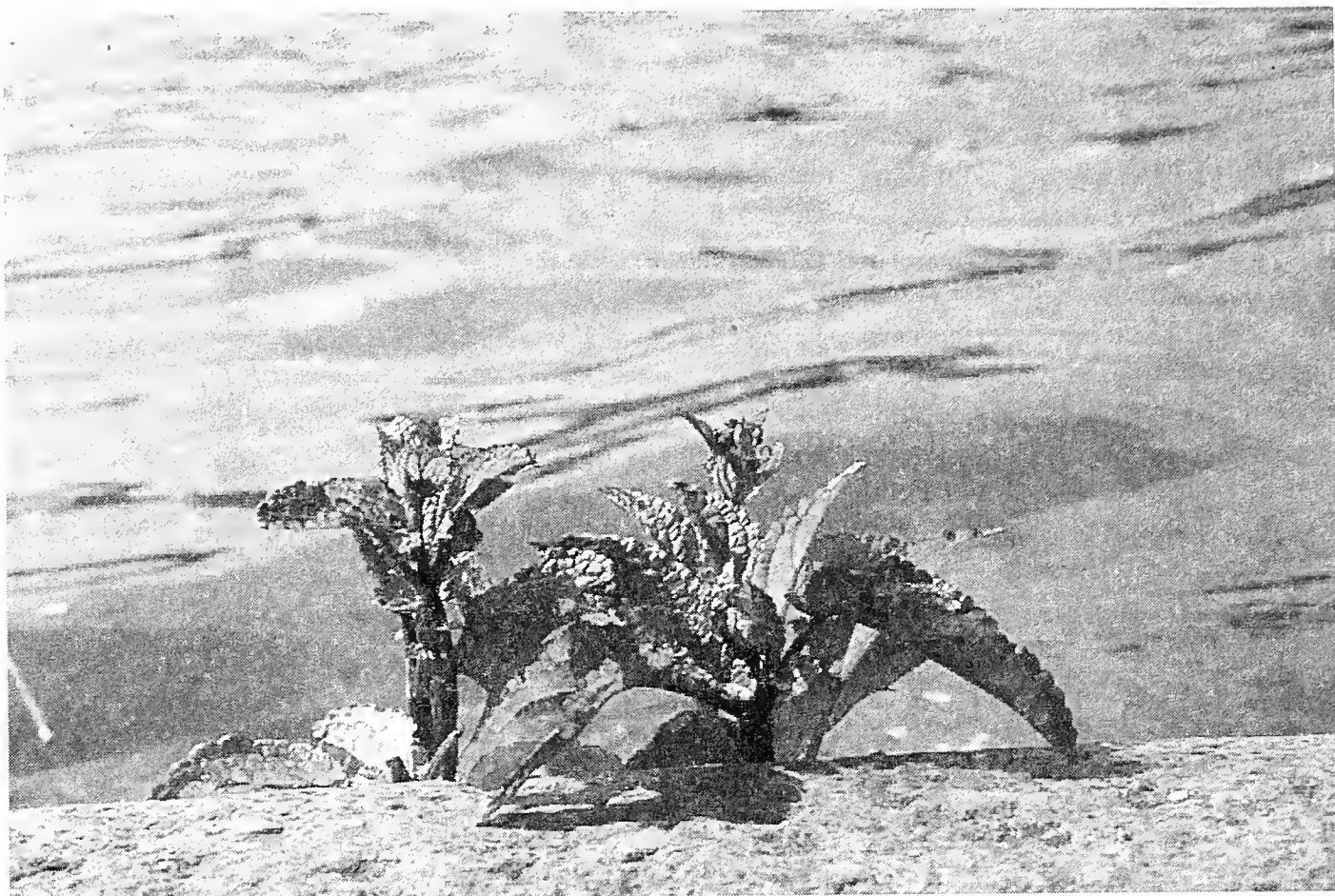


FIG. 6. Water figwort *Scrophularia auriculata* is strongly established around The Serpentine.

Photo: Elinor Wiltshire

- W A *L. purpureum* red dead-nettle.
 A *L. amplexicaule* henbit dead-nettle. **H** – in bed S of tennis courts, June 1989; on site of Serpentine Restaurant, July 1991. **K** – near Victoria Gate, June 1990.
 A *Galeopsis tetrahit* common hemp-nettle. **K** – infill sites, July 1988.
Scutellaria galericulata skullcap. **H** – 1 plant on N side of Serpentine near bridge, August 1990; several plants on S side near bridge, July 1992 and July 1993.
 W *Glechoma hederacea* ground ivy. Seen only once. **K** – on disturbed ground N of Flower Walk, July 1989.
 W A *Prunella vulgaris* selfheal. In secluded grassy areas such as bank overlooking Knightsbridge, as noted by Allen, and in the Henry Moore Arch enclosure.
 W A *Lycopus europaeus* gipsywort. Well established round Serpentine and occasional by The Long Water.
 A *Mentha spicata* spear mint. **K** – 1 plant in enclosure on E side of The Long Water, July 1988.

PLANTAGINACEAE

- WKA *Plantago major* greater plantain.
 WKA *P. lanceolata* ribwort plantain.

BUDDLEJACEAE

- A *Buddleja davidii* butterfly-bush. In stonework of bridge, October 1990.

OLEACEAE

- W A *Fraxinus excelsior* ash. **H** – seedling by Dell, July 1993.

SCROPHULARIACEAE

- Verbascum thapsus* great mullein. **K** – on E side of The Long Water, July 1989 and June 1993.
 W A *Scrophularia auriculata* water figwort. **H** – strongly established around The Serpentine (Figure 6).

- A *Mimulus moschatus* musk. **K** – in shrubby bed behind Albert Memorial, June 1989 (recorded by Allen in this area).
Cymbalaria muralis ivy-leaved toadflax. **K** – persistent on wall in front of Magazine (Allen 1967 pers. comm.).
Linaria vulgaris common toadflax. **H** – on site of Serpentine Restaurant, September 1991 (also recorded by Kent 1942, in Kent (1960)).
- A *L. purpurea* purple toadflax. **K** – 1 plant in shrubbery NW of bridge, 1988 (noted in this area by Allen in 1961).
- A *Veronica serpyllifolia* thyme-leaved speedwell. **H** – by tennis courts, August 1988. **K** – by Serpentine Gallery, August 1988; by Henry Moore Arch, May 1993.
- K *V. chamaedrys* germander speedwell. **K** – in enclosure by Lancaster Gate, May 1993.
- W A *V. arvensis* wall speedwell. **H** – on disturbed ground near North Carriage Drive, July 1989; near tennis courts, June 1993. **K** – infill near Magazine, September 1988; disturbed ground N of Albert Memorial, July 1989.
- WKA *V. persica* common field-speedwell. **H** – infill sites, July 1988; near tennis courts, June 1993.
V. filiformis slender speedwell. **K** – along railing by Marlborough Gate, June 1993 (det. D. H. Kent and J. M. Mullin).
V. hederifolia ssp. *lucorum* ivy-leaved speedwell. **H** – by railings near Bird Sanctuary in Nursery enclosure, March 1993.

RUBIACEAE

- Sherardia arvensis* field madder. **K** – 3 plants under tree by Marlborough Gate, May 1993.
- W A *Galium verum* lady's bedstraw. **K** – 1 plant in lawn near Orangery, July 1989; numerous plants in lawn E of Kensington Palace, August 1990; a few plants at previous site, July 1993 (also seen here by Warren and Allen).
- WKA *G. aparine* cleavers. **H** – by boat-stage, May 1993. **K** – on introduced soil, July 1988.

CAPRIFOLIACEAE

- A *Sambucus nigra* elder. Occasional.

DIPSACACEAE

- WKA *Dipsacus fullonum* wild teasel. **H** – 1 plant in disturbed ground by Rotten Row, June 1990. **K** – infill sites, July 1988; a persistent colony varying between 1 and 20 plants on E bank of The Long Water (recorded here by Warren, Kent and Allen).

ASTERACEAE

- Arctium lappa* greater burdock. **H** – a massive plant by tennis courts, August 1990; about a dozen seedlings at same site, August 1991.
- KA *A. minus* lesser burdock. **H** – in Ring enclosure, August 1989; 1 plant by Rotten Row, April 1990.
Carduus crispus ssp. *multiflorus* welshed thistle. **H** – numerous on site of Serpentine Restaurant, July 1991; 1 plant in Meadow, August 1991. **K** – 1 plant by Temple Lodge, August 1991.
- WKA *Cirsium vulgare* spear thistle.
- WKA *C. arvense* creeping thistle.
- A *Centaurea nigra* common knapweed. **H** – 1 plant by North Ride, July 1988; patch of c. 30 plants in grass towards Park Lane, August 1989.
- WKA *Lapsana communis* nipplewort.
- WKA *Hypochaeris radicata* cat's-ear.
- WKA *Leontodon autumnalis* autumn hawkbit. Occasional patches. **H** – W of Ring, August 1989; W of Marble Arch, September 1989. **K** – S of Victoria Gate, August 1989.
- A *L. saxatilis* lesser hawkbit. **H** – S of Victoria Gate, SE of Ring, August 1989.
- A *Picris echioides* bristly oxtongue. Common on disturbed ground.
P. hieracioides hawkweed oxtongue. Seen only once. **K** – in disturbed patch N of Flower Walk, July 1989.

- WKA *Tragopogon pratensis* ssp. *pratensis* goat's-beard. **H** – 2 plants by tennis courts. June 1989 and 1 plant in May 1990 (noted in this area by Warren, Kent and Allen). **K** – 1 plant W of Queen's Gate, July 1993.
- WKA *Sonchus arvensis* perennial sow-thistle. **H** – a persistent colony by Bird Sanctuary; several plants among post-flowering daffodil clumps near Dell, April 1990. **K** – a row of plants by Albert Memorial, August 1989.
- WKA *S. oleraceus* smooth sow-thistle.
- WKA *S. asper* prickly sow-thistle.
- KA *Lactuca serriola* prickly lettuce. **H** – by Bird Sanctuary in Nursery enclosure, June 1989; site of Serpentine Restaurant, July 1991.
- Cicerbita plumieri* hairless blue sow-thistle. **H** – 1 plant in post-flowering daffodil patch near Dell, May 1993 (det. K. J. Adams. New Middlesex record. Specimen in BM).
- WKA *Taraxacum officinale* dandelion.
- Crepis tectorum* narrow-leaved hawk's-beard. **H** – in resown patch W of Ring, summer 1988 and in similar sites during summer 1989 (det. J. M. Mullin. New Middlesex record. Specimen in BM).
- W A *C. capillaris* smooth hawk's-beard. Occasional patches. **H** – in lawn by Dell, on bank overlooking Knightsbridge and in grass S of Lido, August 1989. **K** – S of Victoria Gate, August 1989.
- A *C. vesicaria* beaked hawk's-beard. **H** – abundant on bank overlooking Knightsbridge; a few plants near Victoria Gate, August 1989 and May 1990. **K** – abundant by railings W of Queen's Gate.
- A *Hieracium vagum* hawkweed. **K** – a persistent small colony under railings by Alexandra Gate (det. K. J. Adams).
- W A *Gnaphalium uliginosum* marsh cudweed. **H** – by young tree E of Nursery, July 1989. **K** – under chestnut trees N of Flower Walk and by Italian Gardens, August 1988; on peat blocks by Flower Walk, October 1990.
- WKA *Conyza canadensis* Canadian fleabane.
- C. sumatrensis* Guernsey fleabane. **H** – 2 plants by Knightsbridge railings, September 1989. **K** – 1 plant on bank SW of bridge, October 1988 (first appearance in Park?); 2 plants by Serpentine Gallery, August 1989.
- WKA *Bellis perennis* daisy.
- KA *Tanacetum parthenium* feverfew. **H** – persistent in Nursery enclosure.
- WKA *Artemisia vulgaris* mugwort. Occasional at young tree bases and in disturbed ground.
- WKA *Achillea millefolium* yarrow.
- W A *Leucanthemum vulgare* oxeye daisy. Occasional, sometimes the result of planting.
- WKA *Matricaria recutita* scented mayweed. Common in patches.
- KA *M. discoidea* pineapple-weed.
- WKA *Tripleurospermum inodorum* scentless mayweed.
- A *Senecio jacobaea* common ragwort. Sporadic.
- KA *S. squalidus* Oxford ragwort. **H** – on site of Serpentine Restaurant, July 1991. and elsewhere on disturbed ground.
- WKA *S. vulgaris* groundsel.
- KA *S. viscosus* sticky groundsel. **H** – 1 plant in Nursery enclosure, June 1994.
- WKA *Tussilago farfara* colt's-foot. **H** – a colony at rear of Cumberland Lodge. Marble Arch. April 1990; 2 plants in shrubby bed towards Knightsbridge, April 1990.
- Petasites japonicus* giant butterbur. **K** – in enclosure E side of The Long Water, near Italian Gardens (Figure 4).
- Helianthus rigidus* (Cass.) Desf. A species of North American sunflower. **K** – 2 plants on bare ground behind railings near Peter Pan Statue, August 1991 (det. K. W. Page).
- KA *Galinsoga parviflora* gallant-soldier. **H** – 6 plants by railings W of Marble Arch. September 1989. **K** – a few plants by railings N of Flower Walk, July 1990.
- KA *G. quadriradiata* shaggy-soldier.

HYDROCHARITACEAE

- W *Elodea canadensis* Canadian waterweed. **K** – in The Long Water (The Royal Parks Agency).

POTAMOGETONACEAE

- WK *Potamogeton pectinatus* fennel pondweed. **K** – in The Long Water during mid 1980s; and had to be controlled with herbicide (The Royal Parks Agency).

ARACEAE

- Arum maculatum* lords-and-ladies. **H** – in Nursery enclosure, by Bird Sanctuary.

LEMNACEAE

- Lemna minor* common duckweed. **H** – in pond in New Lodge garden (The Royal Parks Agency).

JUNCACEAE

- W A *Juncus bufonius* toad rush. **H** – persistent near Serpentine in bed NE of bridge, as noted by Allen. **K** – patches in grass W of Speke's Monument, July 1993.
 KA *J. effusus* soft-rush. **H** – 1 plant towards Knightsbridge, June 1989. **K** – a patch W of Speke's Monument, July 1988; a few plants NE of Palace Gate, July 1989.
 KA *Luzula campestris* field wood-rush. **H** – on grassy bank overlooking Knightsbridge. **K** – in enclosure by Lancaster Gate, May 1993.

CYPERACEAE

- A *Carex divulsa* grey sedge. **H** – several long-established plants inside railings on E side of Nursery.
 KA *C. ovalis* oval sedge. **K** – W of Speke's Monument, August 1988.
 WKA *C. hirta* hairy sedge. **H** – plentiful in Meadow; a few plants by railings near Park Lane, May 1989. **K** – a few plants in grass near Henry Moore Arch, August 1989.

POACEAE

- A *Festuca arundinacea* tall fescue. **H** – some tussocks in The Meadow.
 W A *F. rubra* red fescue. Abundant in The Meadow and in unmown area in Kensington Gardens.
 W *F. ovina* sheep's-fescue. Occasional.
 WKA *Lolium perenne* perennial rye-grass.
 WKA *Cynosurus cristatus* crested dog's-tail. Occasional.
 WKA *Poa annua* annual meadow-grass.
 WKA *P. trivialis* rough meadow-grass. Locally abundant.
 WKA *P. pratensis* smooth meadow-grass. Locally abundant.
P. angustifolia narrow-leaved meadow-grass. **H** – A few plants found in The Meadow, June 1989.
 WKA *Dactylis glomerata* cock's-foot. In The Meadow and on waste ground.
 WKA *Arrhenatherum elatius* false oat-grass. **H** – clumps in The Meadow. **K** – clump in enclosure by Black Lion Gate, June 1989.
 KA *Avena sativa* oat. **H** – single plants in weedy strip by Rotten Row, June 1989 and July 1993.
 W A *Trisetum flavescens* yellow oat-grass. **H** – 1 plant on bank overlooking Knightsbridge, June 1989.
 WKA *Holcus lanatus* Yorkshire-fog.
 W A *H. mollis* creeping soft-grass. **K** – 1 plant by Serpentine Gallery, July 1988; some patches W of Peter Pan Statue.
Aira praecox early hair-grass. **H** – in heathy parts of The Meadow. **K** – in thin sward N of Round Pond. A Hyde Park record of 1816 is mentioned in the *Flora of Middlesex* (Trimen and Dyer 1869).
 W A *Anthoxanthum odoratum* sweet vernal grass. Occasional in secluded grassy areas.

- A *Phalaris canariensis* canary-grass. **K** – 1 plant NW of bridge, September 1988; 1 plant by railings at Queen's Gate, June 1989.
- WKA *Agrostis capillaris* common bent.
A. castellana highland bent. **H** – 1 plant from The Meadow, July 1990 (det. T. A. Cope).
- W A *A. stolonifera* creeping bent. **H** – frequent in The Meadow.
- K *A. canina* velvet bent. **H** – plants in The Meadow, June 1989.
Polypogon viridis water bent. **H** – numerous plants in Nursery enclosure, June 1994 (det. B. Wurzell).
- WKA *Alopecurus pratensis* meadow foxtail. **H** – locally abundant in The Meadow.
A *A. geniculatus* marsh foxtail. **H** – patches in The Meadow.
- W A *A. myosuroides* black-grass. Common in disturbed patches.
- W A *Phleum pratense* timothy. **H** – locally abundant in The Meadow.
KA *P. bertolonii* smaller cat's-tail. Occasional — locally common in The Meadow.
- WKA *Bromus hordeaceus* soft-brome. **H** – especially abundant by North Carriage Drive after daffodil flowering.
KA *Anisantha sterilis* barren brome. **H** – 1 plant by tennis courts, June 1989; 1 plant on site of Serpentine Restaurant, July 1991. **K** – 1 plant by Italian Gardens, June 1993.
Ceratochloa carinata California brome. **H** – a patch at N edge of The Meadow, July 1993.
- K *Brachypodium sylvaticum* false brome. **K** – 1 plant at foot of young tree by North Walk, June 1989.
- WKA *Elytrigia repens* common couch. In disturbed patches.
A *Hordeum distichon* two-rowed barley. **H** – a few plants in bare patch near Victoria Gate, July 1988.
- WKA *H. murinum* wall barley.
KA *Secale cereale* rye. **H** – 1 plant in disturbed ground by Rotten Row, June 1989.
A *Triticum aestivum* bread wheat. **K** – 1 plant by railings at Queen's Gate, June 1989.
Setaria pumila yellow bristle-grass. **K** – 1 plant on bank SW of bridge, October 1988 (det. E. Nic Lughadha). Also recorded by B. Wurzell, 1966, in Kent (1967).
Zea mays maize. **H** – 1 plant near Bandstand, July 1989. **K** – 1 plant by Italian Gardens, July 1989.
Arthraxon hispidus (Thunb.) Makino. **K** – under railings by Palace Gate, September 1989 (det. J. M. Mullin. First British record. Specimen in BM).

LILIACEAE

- Hyacinthoides non-scripta* bluebell. **H** – in grass S of The Meadow, May 1993 (T. Freed pers. comm.)
H. hispanica Spanish bluebell. **K** – E side of The Long Water (Allen 1968 onwards, pers. comm.).
Muscari comosum tassel hyacinth. **H** – 1 plant in uncut grass opposite Bandstand, June 1990.
Allium ursinum ramsons. **H** – in garden of Ranger's Lodge — probably introduced with soil (The Royal Parks Agency).

BRYOPHYTES

Although there does not appear to be any previous general list of the mosses and liverworts of the park, there are a few interesting old records which were published by Smith and Sowerby (1790–1814) in their *English botany*. Specimens of *Fissidens bryoides*, *F. taxifolius* and *F. adianthoides* were collected in 'a shady pit in Kensington Gardens, towards Bayswater Gate' in 1796 and 1797 by Charles Abbot and John Hemsted, well-known botanists of the period. A specimen of *Pseudephemerum nitidum* from the Gardens is also featured in this work.

Moving to more recent times, Kent (1975) reports a Kensington Gardens find of *Pohlia nutans* by J. C. and M. W. Gardiner in 1967. Later J. C. Gardiner also found *Lophocolea heterophylla* there, and most unexpectedly *Odontoschisma denudatum*, of which he wrote to Kent in January 1984: 'Found in 1983 mixed with *Campylopus paradoxus* on peaty soil introduced to make the Azalea Garden. As neither fresh soil nor new plants had been introduced for some years prior to 1983, the liverwort appears to have survived in this surprising location for probably about 10 years'.

The park does not provide many congenial habitats for mosses. They are absent from large stretches of sward, though in places where cover is thin *Eurhynchium praelongum* is common and *Brachythecium rutabulum* fairly frequent. Where vestiges of heathy conditions persist *B. albicans* is often to be found. The invasive *Campylopus introflexus*, first recorded in Britain in 1941, is strongly established in suitable sites throughout the park, perhaps displacing *Campylopus paradoxus* which is much scarcer. In heathy ground at the south edge of The Meadow there is a patch of *Rhytidiadelphus squarrosus*, with a small colony of *Polytrichum juniperinum* under a nearby oak. A similar colony of *P. juniperinum* persists under an oak near Lancaster Gate.

Occasional minute specimens cling to tree bases and exposed roots — these include *Dicranoweisia cirrata* and *Amblystegium riparium*. There are few shaded walls, the most fertile being along the Bayswater Road by Lancaster Gate. Here *Tortula muralis* is abundant and *Bryum capillare* common. *Grimmia pulvinata* is found occasionally in more exposed sites. Peat blocks and rockery boulders provide mini-habitats for a few species which would not otherwise occur in the park, such as *Polytrichum formosum* and *Cirriphyllum crassinervium*. But the greatest variety of mosses is along path edges, on bare soil or cracked asphalt. These produced the most interesting find — *Hennediella macrophylla*, an alien considered to be of New Zealand origin, first recorded in Britain in 1965 and so far known here only from the Thames and Tweed basins.

In all a total of 46 bryophyte species and subspecies was recorded, as is shown in the following list. Dates are given when a specimen was seen only once.

MOSSES

POLYTRICHACEAE

Polytrichum formosum. **K** – stunted plants on peat block in rhododendron bed by Flower Walk, August 1992.

P. juniperinum. **H** – a small colony in heathy patch under oak S of The Meadow. **K** – a similar colony under oak by Lancaster Gate.

Atrichum undulatum. **K** – stunted plants on peat block by Flower Walk, August 1992.

DICRANACEAE

Ceratodon purpureus. Common in thin sward and on path edges.

Dicranella heteromalla. Occasional minute tufts at tree bases.

Dicranoweisia cirrata. **H** – a good fruiting specimen found loose on ground by Dell Restaurant, January 1992. **K** – at base of horse-chestnut near Speke's Monument; at base of ornamental tree near Lancaster Gate.

Campylopus paradoxus. **K** – in sward W of Serpentine Gallery; in sward under oak near Lancaster Gate.

C. introflexus. Widespread in suitable sward.

FISSIDENTACEAE

Fissidens bryoides. **K** – on low wall at rear of Orangery, April 1991; fruiting plants on vertical edge of grass verge by Flower Walk, February 1993.

F. taxifolius. **K** – on low wall at rear of Orangery, April 1991.

POTTIACEAE

- Tortula intermedia*. **K** – path edge near Serpentine Gallery, November 1992 and January 1993.
T. muralis. Common on walls and paths.
Pottia intermedia. **K** – path edge by Henry Moore Arch, November 1992.
P. truncata. **K** – on vertical edge of grass verge by Flower Walk, February 1993; path edge near Marlborough Gate, March 1993.
Phascum cuspidatum. **K** – path edge near Marlborough Gate, March 1993.
Hennediella macrophylla. **K** – path edge near Henry Moore Arch, July 1992 (det. K. J. Adams); plants in fruit by path edge near Marlborough Gate, March 1993.
Barbula convoluta var. *convoluta*. **K** – on wall by Lancaster Gate, July 1993.
B. convoluta var. *commutata*. **K** – in disturbed soil by path edge near Marlborough Gate, March 1993.
B. unguiculata. Common in bare patches.
B. hornschurchiana. **K** – path edge by Serpentine Gallery, November 1992; by Marlborough Gate, March 1993; by Henry Moore Arch, July 1993.
B. fallax. **K** – path edge by Marlborough Gate, July 1993.
B. cylindrica. **K** – disturbed soil near Marlborough Gate, March 1993.

GRIMMIACEAE

- Grimmia pulvinata*. **K** – on wall-top near Palace Gate; on stonework of bridge.

FUNARIACEAE

- Funaria hygrometrica*. Common in bare patches and along path edges.

BRYACEAE

- Pohlia nutans*. **H** – in heathy grass S of The Meadow, June 1991. **K** – in disturbed soil by path edge near Marlborough Gate, March 1993.
Bryum capillare. Common on path edges and walls.
*B. caespiticiu*m. Frequent on path edges.
B. bicolor. As above, especially adjoining Serpentine.
*B. gemmiferu*m. As above.
*B. argenteu*m. Common on paths and walls.
B. rubens. **H** – by Serpentine near boathouse, March 1992.

MNIACEAE

- Plagiomnium undulatu*m. **K** – a colony under weeping beech near Lancaster Gate.

ORTHOTRICHACEAE

- Orthotrichum diaphanu*m. **K** – path edge by Henry Moore Arch, January 1993.

AMBLYSTEGIACEAE

- Amblystegium serpens*. Occasional. **K** – in shrubbery between Marlborough Gate and Lancaster Gate.
A. riparium. **H** – on exposed root of poplar W of Nursery, November 1993.

BRACHYTHERCIACEAE

- Homalothecium sericeu*m. **H** – on rockery boulders by tennis courts.
Brachythecium albicans. Frequent in heathy sward.
*B. rutabulu*m. Common in suitable sward.
*Cirriphyllum crassinervi*um. **H** – on rockery boulders by tennis courts.
*Rhynchostegium confertu*m. Occasional at tree bases.
*Eurhynchium praelongu*m. Very common among grasses and on moist bare soil.

HYPNACEAE

Hypnum cupressiforme var. *cupressiforme*. Very sparse in heathy sward.

H. cupressiforme var. *resupinatum*. At base of horse-chestnut N of Speke's Monument, November 1993.

Rhytidiadelphus squarrosus. **H** – in heathy sward at S edge of The Meadow.

LIVERWORTS

LUNULARIACEAE

Lunularia cruciata. **K** – vertical edge of grass verge by Flower Walk.

Marchantia polymorpha. **H** – along Serpentine between bridge and Lido. **K** – vertical edge of border near Victoria Gate.

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Branch Hill Combe, Hampstead: a botanical survey

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Introduction

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In June 1993, the London Natural History Society was approached by The Heath and Old Hampstead Society for assistance in carrying out a botanical survey of Branch Hill Combe in Hampstead. This site had come under pressure for development from the London Borough of Camden, who had included it in their draft Unitary Development Plan as suitable for ‘residential’ development, despite commitment elsewhere in the document to retaining open space in the borough. The Heath and Old Hampstead Society had campaigned to change this designation to ‘Open Space’, in order to assure the protection of the site, and it was felt that a detailed botanical survey would be of assistance in furthering that aim. The LNHS agreed to provide a small grant to enable Brian Wurzell to carry out a survey.

The site consists of steep slopes forming part of the edge of the Bagshot Sands capping of the North London Heights. It drops down from the corner of the roads Branch Hill and Oak Hill Way. The latter has changed little over the years and remains a muddy, unmade country lane which is barred to through vehicular traffic.

The map (Figure 1) shows the component parts of the site referred to in the text. It is roughly square, with a side length of about 250 metres. The original Ordnance Survey map of 1822 shows a roughly square private enclosure corresponding to the boundaries of the original Branch Hill estate prior to hiving off the blocks now represented by Oak Tree House, Combe Edge, Heysham and part or all of the Spedan Towers site. This indicates no change of use since 1820, and the argument is thus supported that the site’s overall antiquity calls for sensitive assessment and ecological respect throughout. Older maps suggest that the corner now holding allotments was a continuous part of the original manorial waste that became known as Hampstead Heath.

The site includes a number of differing component parts of which the following four are examined in detail:

- 1. Heysham Open Space:** a partly open, partly wooded area that juxtaposes recently recolonized grassland with irregular belts of mature trees.

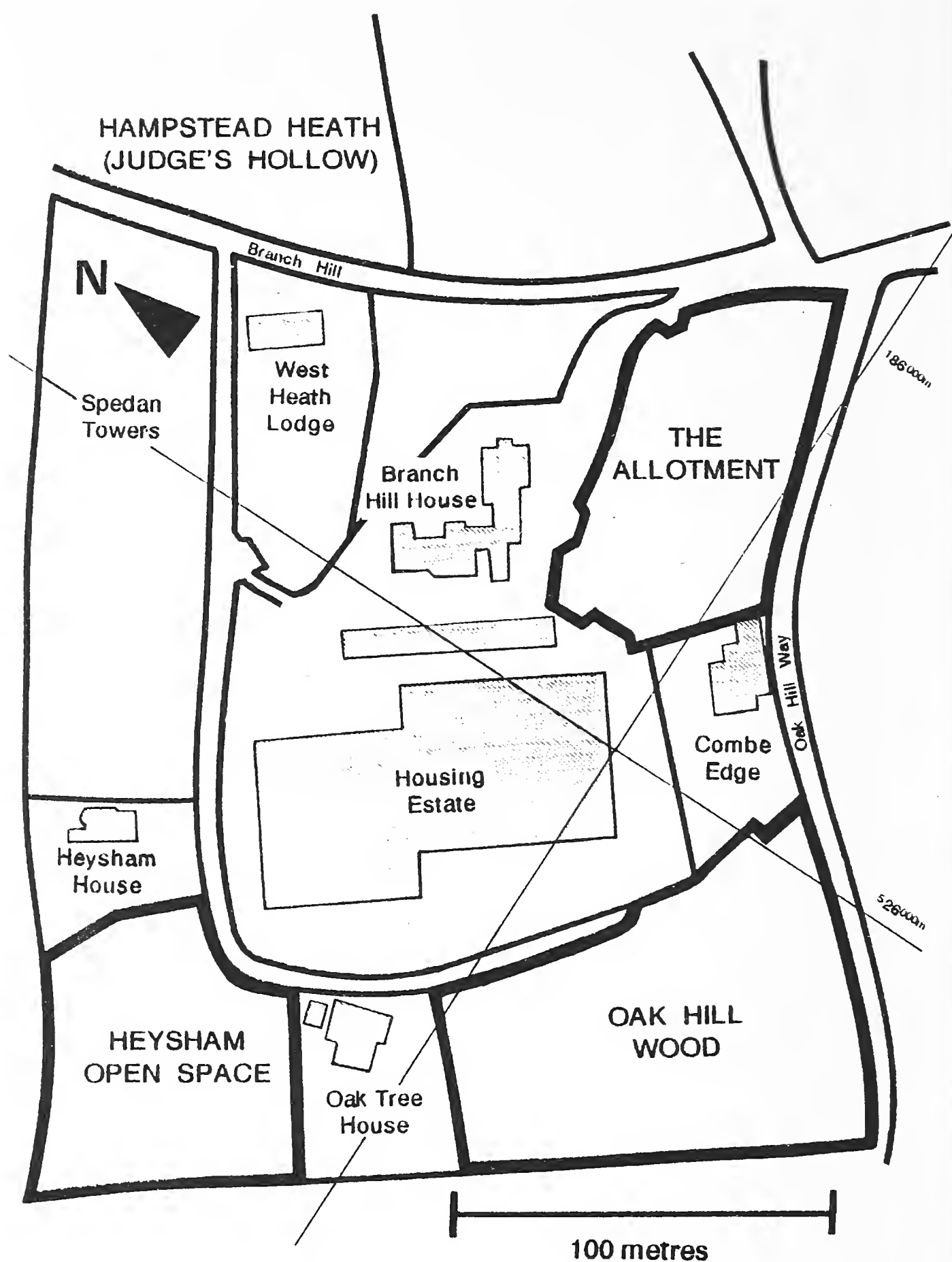


FIG. 1. Branch Hill Combe, Hampstead.

2. Oak Hill Wood: a more extensive, more rural-looking tree and shrub area locally called Bluebell Wood. The soil and flora more closely resemble those parts of the Hampstead Heath complex which show a similar geology and topography.

3. The allotment: a steep-sided tree-encircled amphitheatre at the base of which are cultivated allotments.

These three sectors are municipally owned land which the borough intends to sell to developers.

4. The north-east section of the site is rather indeterminate on the ground, abutting an area of large Victorian houses with deeply shaded private gardens. Oak Tree House and Combe Edge are similar properties, Heysham House is more modern. Spedan Towers and West Heath Lodge are modern blocks set in their own grounds. Mature trees of fine stature with widely spreading canopies have been retained.

The central slope of the site is crowned by the original stately home, now extended and converted into an old people's home, which overlooks a terraced block of tightly packed housing.

The London Ecology Unit's book *Nature conservation in Camden* (White, Keech and Game 1993) devotes space to a description of the site, which it treats as one ecological unit.

Botanical nomenclature follows Stace (1991).

Abstract

In June 1993, The Heath and Old Hampstead Society, in liaison with the LNHS, asked me to examine and document the flora of Branch Hill for the purpose of aiding local nature conservation initiatives. Two field visits were made, one with Ray Softly on 7 July, one on my own on 2 September. On each visit, all publicly accessible parts of the site were examined in general. On the second visit, three areas of particular nature conservation importance were botanized more intensively; two hours were also spent exploring Judges Hollow on the nearby West Heath. On both occasions my approach was threefold, a) to list all native and naturalized and most of the introduced flowering plants, b) to map a representative selection of the hundreds of mature and semi-mature trees currently surviving, and c) to note also some of the more interesting and unusual associated organisms, particularly insects, gall-mites and parasitic fungi, for these specialized dependents often provide clues to some of the subtler features of an ecosystem, quite apart from the mere presence of a host plant. The tree map and data on the above-mentioned organisms are held by The Heath and Old Hampstead Society.

The survey

Local context

Historically, ecologically and still, in places, visually, Branch Hill is closely linked to Hampstead Heath. Its prevailing soil conditions, elevation, climate and characteristic tree species are demonstrably similar and contribute to a sense of environmental unity overall. Indeed the old houses, trees, scrub, grassland and allotment are felt to harmonize here — to combine important history, architecture and ecological resource — and this harmonious quality is much cherished by residents. Hampstead Heath proper offers more open greenery and fewer wild species, a paradox not uncommon when town and countryside are brought into comparison. The link remains valid and the differences are valued. Neither place duplicates or lessens the other.

It is debatable whether those parts of Branch Hill which are now in private hands must, by their separation, have a reduced nature conservation value. This may or may not be true, depending on what each landowner chooses to do on his or her estate. I have chosen Heysham Open Space, Oak Hill Wood and the allotments as prime sections to work on, because they are public, more likely to be threatened by any development proposals and more widely enjoyed for recreation. But privately managed land could be made equally or more interesting. In London, relative nature conservation value is frequently tethered to the relative success of the sycamore. In land public or private, a dense, mature canopy of this tree will permit only a sparse ground cover beneath, and even that will usually include more sycamores struggling upwards in the form of etiolated saplings. At Branch Hill, such conditions can be observed on many plots of ground. Beneath the even thicker canopies of yew, beech, hornbeam and horse chestnut, undergrowth may be sparse or non-existent.

A general appraisal of the mature trees and shrubs

Some of the largest native trees are of very impressive size, probably more than two hundred years old and entirely deserving of TPOs. Any such pre-Victorian specimens,

of pedunculate oak for example, might reasonably be described as members of the original flora before housing development partly amputated Branch Hill from the surviving Heath; thus there remains important ecological continuity on site through the centuries. Other native species have most likely also been present continuously with a quicker turn-over of individuals; for example our now mature ash, hawthorn, hornbeam, silver birch, elder, holly, rowan and wild cherry specimens may not themselves antedate 1800, but some examples of these species may be presumed to have grown on this land throughout the period, together with the invertebrates and parasitic fungi still to be observed on them. Sessile oak accompanies the pedunculate species in Oak Hill Wood and is also widespread in Kenwood; although much regeneration has taken place in both woods during the present century, the older native trees clearly hark back to the pre-enclosure land uses of the seventeenth century.

The remaining Branch Hill natives comprise species indigenous in other parts of England, but, as deduced from their pattern of occurrence, are only introduced here. These include yew (which produces small numbers of spontaneous seedlings), white beam, white willow, field maple, common lime and beech. Some doubt is currently cast upon the status of beech in Great Britain anyway, based on the absence of fossil pollen until the English Channel had filled, by which time such heavy fruits could not have dispersed from the Continent to this country without importation by humans. Certainly the copper beech at the south-east corner of the allotment represents an alien variety.

Regarding alien trees and shrubs, two categories apply, namely species which were deliberately introduced and species which have spontaneously colonized; this recognizes that some of the former have also self-sown locally since they were planted. Again there occur certain trees of magnificent stature, not least some of the horse and sweet chestnuts which modestly regenerate as well. Sycamore, notwithstanding that its saplings are the most prolific of our woody invaders, offers outstanding ecological and aesthetic value as a mature tree, and venerable examples should be prized as highly as contemporaries of any other native or alien species. Of impressive proportions, too, are the single London plane, the single black Italian poplar and the remaining two false Lombardy poplars, which do not produce seedlings here. (Others, originally planted as a short row at the bottom of Oak Hill Wood, were recently felled as dangerous). They are dubbed 'false' because their broader silhouettes demonstrate hybridity between the Lombardy and black poplars; such crosses, known as cultivar 'Plantierensis' are much commoner in London than the very slender, straight-sided true Lombardies. A single planted or escaped grey poplar thrives in Oak Hill Wood. Its original cluster of trunks has grown to massive proportions, and a couple of these then succumbed to winter storms leading to a vigorous expanse of regrowth and a generous supply of dead timber. There are also numerous suckers developing over a wide area, and some have already attained young tree dimensions in their own right, to an extent which poses the management issue whether or not some reduction may be desirable in order to restore a more satisfying balance with the native flora. Past records of white poplar and aspen from here should be viewed with doubt, close scrutiny revealing neither. Grey poplar is a hybrid between the two, its sucker foliage rather resembling the former species and its adult foliage rather resembling the latter.

The genus *Sorbus* is well represented in Hampstead. Native rowan apart, the central part of Oak Hill Wood carries a single bird-sown seedling of the Swedish whitebeam *S. intermedia*, one metre tall, plus, higher up, a single bird-sown sapling of the service tree of Fontainebleau *S. latifolia*, three metres tall. The native whitebeams at West Heath Lodge do not self-sow. The native wild service tree occurs at Kenwood and the recently-described European *S. croceocarpa* flourishes and fruits at the top of Judges Hollow.

Rubus is a much under-represented genus in surveys because of its taxonomic complexities, but some significant discriminations can be made. The alien taxa often form robust stands of their own in more recently disturbed habitats. At Branch Hill, four alien *Rubi* are identified. Garden blackberry *R. armeniacus* (formerly *R. procerus*) with its impenetrably stout purplish stems and tough white-undersided leaves is a

characteristic urban alien with superior-tasting fruit, well established at Heysham Open Space in particular. Raspberry *R. idaeus* is well naturalized in Oak Hill Wood with better fruiting varieties grown in the allotment. Cut-leaved or parsley-leaved blackberry *R. laciniatus* occurs as a bird-sown seedling, again in Oak Hill Wood, but is not cultivated nearby. A loganberry *R. loganobaccus* is also grown in an allotment plot. Native and alien *Rubus* species do tend to host different ranges of invertebrates and parasitic fungi.

Other alien fruit trees in the family Rosaceae are scarce, domestic apples, a pear and a plum being found only in the allotment where no seedlings were noted. In their company grow blackcurrant and gooseberry bushes, with a young bird-sown example of the latter also growing wild on the roadside just south-east of Heysham Open Space. In the allotment, too, there are scattered hybrid tea roses, a group of Lawson's cypress and a very large naturalized grapevine. Extensive old gardens in the northern part of the site support stands of sombre evergreens much loved by the Victorians. Adding even more shade to that of the canopy above, these include Japanese privet, common privet, *Aucuba japonica*, Highclere holly, elder and cherry laurel. They do have the virtue of offering sheltered sanctuary to nesting birds.

Ornamental shrubs such as *Lonicera japonica*, *Clematis* species, *Hebe* species, *Hydrangea petiolaris*, *Ceanothus thyrsiflorus* and *Fuchsia* hybrids are introduced into the central terrace gardens, but are not considered relevant for mapping. One very robust *Buddleia davidii* nearby is mapped because it commands a wide enough view to attract numerous insects. A self-sown *Laburnum anagyroides* sapling occurs on the artificial bank at Heysham Open Space and a New World hawthorn, *Crataegus* × *grignonensis* has been planted by the roadside eastwards. This is a hybrid between the North American *C. crus-galli* and the Mexican *C. pubescens* inheriting the Mexican propensity to hold its leaves until the end of the year. It is quite an uncommon member of its genus to find in cultivation, and one of the few which has not yet, to my knowledge, produced seedlings in the wild.

The four component parts

1. Heysham Open Space

This north-western section of Branch Hill comprises three habitat types, semi-penetrable mature woodland of secondary origin, coarsely vegetated perimeter banks approximately two metres tall, and heavily trodden grass on poorly drained soil. It is used as a rough play area, as evidenced by cycle tracks, small amounts of litter and a central bonfire patch. This is not a measure of ecological devaluation, but the realization of a social need. A plot of ground does not have to be precious to be valuable, and it is reassuring to know that many forms of recreation and leisure can be catered for within short walking distance.

The woodland area is predominantly covered by sycamore, with one specimen each of ash, common lime, black Italian poplar, horse and sweet chestnut, all mature and fine. The northern strip of this area becomes quite inaccessible due to rank undergrowth, so a complete coverage was not possible. Attention should be drawn to the rampant growth of Japanese knotweed and ground elder, which are space-fillers offering little ecological or aesthetic quality. The banks are clothed with more diverse herbaceous vegetation, together with some sycamore saplings; this includes creeping thistle, stinging nettle, Yorkshire fog, a mixture of garden blackberry and native brambles, mugwort, hoary ragwort, hairy willow-herb, cock's foot, false oat grass, coltsfoot, couch grass, broad-leaved dock, Russian comfrey, creeping cinquefoil, hedge bindweed, nipplewort and further stands of ground elder and Japanese knotweed.

More time was spent examining the central area of short trampled grass where species were fewer but richer in associated organisms. On hard compacted soil, which would certainly be waterlogged in winter, creeping bent grass was codominating with creeping buttercup, and both were infected with fungal growths. Where the grassland

was drier, Yorkshire fog returned in isolated tufts, the codominants now being perennial ryegrass with white and red clovers; cock's-foot, dandelion, greater plantain and autumn hawkbit were also an integral part of a characteristic community. Both clovers were hosting the brown-speckled discomycete parasite *Pseudopeziza trifolii*, greater plantain was coated with the mildew *Erysiphe sordida* and, returning to the banks, the rust *Coleosporium tussilaginis* was observed on coltsfoot, another rust *Puccinia lapsanae* was on nipplewort, and fungal galls *Protomyces macrosporus* were distorting the petioles of ground elder.

Regarding insects, one or two speckled wood, large skipper and holly blue butterflies were noted here, while on the boles of young sycamores clusters of the horse chestnut scale *Pulvinaria regalis* were especially conspicuous. This Continental species was first recorded in the London Area in 1964, and has since increased to prolific quantities throughout the city, particularly on common lime, sycamore, Norway maple and horse chestnut itself. The dried shells of its parthenogenetic females sitting on their cotton-shrouded egg clusters are a familiar sight, frequently arousing public concern for the well-being of their host trees. However one observes no evidence that significant damage ever results.

2. Oak Hill Wood

In spring, native bluebells, cow parsley and red campion would be abundantly flowering; one may reasonably guess at the presence of lesser celandine, too, adding more colour still to the beauty of this wooded hillside. Native bluebells along with native brambles link the present wood with the past heath, and boost arguments of some ecological continuity for centuries. During the present survey, the midsummer and early autumn seasons were appreciated, when the trees themselves were in full leafy majesty and the woodland floor more shady and more overgrown.

At the lower end of the wood, near Oak Tree House, exceptionally fine horse and sweet chestnuts effectively reduce the woodland floor to bare leaf-litter, so dense are their canopies. Climbing higher, the flora becomes more diverse, with pedunculate and sessile oaks, birch, rowan, holly and hawthorn all strongly represented, and further mixed with grey poplar trunks and suckers on the brow of the hill. Dead timber is also plentiful, especially that of the grey and false Lombardy poplars, to provide an essential medium for fungi and invertebrates. The shaded ground flora is rich in ivy, fine bent grass, creeping soft grass, foxgloves (not in flower) an over-abundance of small-flowered balsam (now considered pestilential in Hampstead) and a diversity of brambles of which one interesting narrow-leaved native form is particularly well distributed and plentiful. Further south, the wood has been partly cleared and herbaceous vegetation is rapidly recolonizing. Most of this comprises false oat grass, Yorkshire fog, rose-bay willow-herb, silver birch and sycamore seedlings, stinging nettles, hawthorns and rapidly encroaching brambles; not least there is a stand of Japanese knotweed which should be watched. One way or another, this untidy open area will not remain open for long, and some management operations will be desirable very soon if all is not to become impenetrable.

One important feature of Oak Hill Wood is that it covers a steep east-facing slope. Branch Hill Combe as a whole is notably undulating for its relatively small area of 3.9 hectares, its steepest inclines being Oak Hill itself and the opposite hill which is occupied by terraced dwellings. More detailed assessments of the wood should take into account that it is quick draining, exposed to cold winter easterlies and blessed with less sunshine than the surrounding land. These factors will be particularly significant in invertebrate studies, flying insects being extra sensitive to differences in humidity level, light intensity and air movement.

3. The allotment

Mature trees in planted rows and broader belts form effective windbreaks along most of the borders of this south-eastern section of Branch Hill. Being low lying, the soil is

rich and fertile, relatively damp and, wherever broken and left to its own devices, covered with vigorous weeds. Floristically this area is richest in species. Many of these are short-lived annuals which are ready to take advantage of short-lived habitats. Perennials include wayside and rough grassland natives and dozens of horticultural relics. Although an old and partly neglected area, many plots are still used to good advantage. It is interesting to recall the history of treeless grazing land; certainly it is not treeless now, for pussy willows and sallows have encroached and evergreens and fruit trees have been planted further towards the middle. Over twenty species of parasitic fungi were identified on cultivated and wild plants in this rewarding space. Outstanding items included the silver-leaf infection of plum caused by *Chondrostereum purpureum*, the uncommon rust *Puccinia aethusae* on fool's parsley, and another *Puccinia* on fennel which, upon SEM examination, is considered almost certainly new to science (Dr Tom Preece pers. comm.). Readers are encouraged to look for this species in southern England, and pressed specimens would be most welcome.

4. The north-east section

This is where mature forest picturesquely combines with Victorian houses, their private gardens dominated by imposing trees, vigorous shrubby thickets and bleakly shadowy herbaceous expanses in between where little is cultivated. A sizeable proportion of this private land was not surveyed, but it was still possible to gain a useful impression of its overall character from the road. No unusual native plants were observed here. Most of the accessible trees and taller shrubs are now mapped, and at least the finer examples should be preserved. A few herbaceous plants seen on shady roadside walls did not occur elsewhere at Branch Hill; these included hart's-tongue fern and Sumatran fleabane, the last still scarce in this district although undoubtedly destined to increase fast as it has already done in central London. A recently cleared area just north-east of the terraced dwellings was found covered with a large stand of stinging nettles, with some creeping thistle, broad-leaved docks and planted Japanese privets — the presence also of Japanese knotweed in stout clumps gives more cause for concern.

Summary

Branch Hill is a complex heterogeneous site, comprising a diversity of architectural, aesthetic and ecological elements. Local opinion stresses that because these elements harmonize well together they should be maintained as near intact as possible. It is especially desired that the area's more historic features, both man-made and semi-natural, should be accorded correspondingly greater reverence by anyone who may suggest degrees of change. The oldest of these features include the largest trees, which range from impressive maturity to incipient senescence, some of them apparently antedating Victorian times. These merit preservation orders while they stand and respect as rich fungus and invertebrate resources after they fall. Examples of such trees occur both in publicly open and in privately owned land. At the shrub level, certain native species have also reached maturity, and while no individual specimen may claim similarly venerable age, it is again reasonable to postulate continuous presence of these species, together with their dependent organisms, since Branch Hill bordered the edge of the original Hampstead Heath. The evenly-spaced abundance of a very distinctive narrow-leaved native bramble (growing with similarly dispersed native bluebells) is valuable indication of the antiquity of Oak Hill Wood, compared with the almost ubiquitous flourishing of garden blackberries *Rubus armeniacus* and segregates of *Rubus* Section *Corylifolii* in urban wasteland and similar secondary habitats.

At the herbaceous level, however, I do not identify plant communities approaching any that are conventionally recognized as primary or relatively undisturbed for centuries. On the contrary, the constituents of the mostly perennial vegetation in Heysham Open Space, and again the large percentage of annual weeds which thrive in the allotment area, are both clear evidence of recent and ongoing human activity. As such, they offer their own brand of ecological interest, which indeed is considerable,

but it would be misleading to feed this interest into a conservation argument which was basically broadcasting historic values. In short, by acknowledging the site's young and old ecologies separately, so may each receive due justice.

Conservation and management

A few practical recommendations can be made in the light of the above. Mature trees and decomposing timber of all species are valuable habitat components to leave *in situ*. Immature alien trees may seriously be reviewed for thinning operations, especially sycamore saplings throughout the overshadowed western half of the site. Spreading grey poplar suckers are also threatening to reafforest Oak Hill Wood and need careful monitoring and reducing each year. Amongst shrubs, garden blackberries should be kept strictly out of the Oak Hill Wood clearing, otherwise they will render it impenetrable in a very short time; native brambles fringing the sunnier borders only may maximize their usefulness to nectar-seeking Lepidoptera and Hymenoptera without invading open space more advantageously occupied by other species. A small thicket of *Rhododendron ponticum* at the top of Oak Tree Hill should also be watched; the chances are that this steep, east-facing wood will be too dry for the kind of rhododendron aggression that has caused major problems in many other British counties, but seedlings should still be removed.

Japanese knotweed inevitably heads the list of herbaceous invaders, its aerial growth in one season characteristically exceeding that of many true shrubs. Unfortunately, it has gained a particularly strong foothold along the western side of Heysham Open Space, with pernicious clumps also well established close to the terraced dwellings and in the Oak Hill Wood clearing. It has been shown in other parts of London that the removal of true woody plants reinvigorates the rhizomes of this alien; conversely, where semi-natural scrub thickens its canopy, the shaded knotweed gradually loses ground. This seems to pose a choice, whether we be patient enough to wait for arboreal competition or energetic enough to dig as deeply as immediate eradication may require. Either way, this pest is an important item on the Branch Hill agenda and should be addressed without delay.

Compared with it, other species may appear minor issues; nevertheless they are worthy of attention. A single giant hogweed at Heysham Open Space needs removal before it multiplies. Ground elder already over-abounds in light shade, again at Heysham Open Space, preventing the colonization of forest floor natives. Small-flowered balsam is a more recent intrusion in our lowland flora, increasingly demonstrating that it can do to woodlands what orange balsam does to sedge-swamps and Himalayan balsam does to stream-banks. In consequence, no longer may these flamboyant exotics be regarded affectionately as novelties, but recognized as remarkably successful invaders into some of our strongest native perennial communities — a remarkable feat for annuals of such fragile, succulent constitution. Therefore I advise that small-flowered balsams at Oak Hill Wood, or indeed anywhere on Hampstead Heath, be hand-weeded each spring before their flowering season, until the seed-bank is exhausted.

Conclusions

Branch Hill's unique environmental personality derives from its special combination of human and ecological attributes. This personality is locally cherished and vehemently defended against major change. I trust that this paper may help those concerned with the site's future to work sensitively in the best interest of all.

Acknowledgements

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TABLE 1. Vascular plants recorded from Branch Hill Combe, Hampstead, July and September 1993.

| | Heysham Open Space | Oak Hill Wood | The allotment |
|---------------------------------|-----------------------|------------------|------------------|
| <i>Acer campestre</i> | — | + | — |
| <i>Acer pseudoplatanus</i> | + | + | + |
| <i>Achillea millefolium</i> | — | + | + |
| <i>Aegopodium podagraria</i> | + | + | + |
| <i>Aesculus hippocastanum</i> | + | + | + |
| <i>Aethusa cynapium</i> | — | — | + |
| <i>Agrostis capillaris</i> | — | + | + |
| <i>Agrostis stolonifera</i> | + | — | + |
| <i>Alcea rosea</i> | — | — | + |
| <i>Alliaria petiolata</i> | — | + | — |
| <i>Anagallis arvensis</i> | — | — | + |
| <i>Anisantha sterilis</i> | — | — | + |
| <i>Anthriscus sylvestris</i> | + | + | + |
| <i>Antirrhinum majus</i> | — | — | + |
| <i>Arctium minus</i> | — | + | + |
| <i>Armoracia rusticana</i> | + | — | + |
| <i>Arrhenatherum elatius</i> | + | + | + |
| <i>Artemisia vulgaris</i> | + | + | + |
| <i>Asparagus officinalis</i> | — | — | + |
| <i>Aster novi-belgii</i> | + | — | + |
| <i>Atriplex patula</i> | — | + | + |
| <i>Atriplex prostrata</i> | + | — | — |
| <i>Ballota nigra</i> | + | + | + |
| <i>Bellis perennis</i> | — | + | + |
| <i>Betula pendula</i> | — | + | + |
| <i>Borago officinalis</i> | — | — | + |
| <i>Brachypodium sylvaticum</i> | — | + | — |
| <i>Brassica napus</i> | — | — | + |
| <i>Brassica oleracea</i> | — | — | + |
| <i>Brassica rapa</i> | — | — | + |
| <i>Bryonia dioica</i> | — | + | — |
| <i>Buddleja davidii</i> | — | — | + |
| <i>Calendula officinalis</i> | — | — | + |
| <i>Calystegia sepium</i> | + | — | + |
| <i>Capsella bursa-pastoris</i> | — | — | + |
| <i>Carex pendula</i> | — | + | — |
| <i>Carpinus betulus</i> | + | + | — |
| <i>Castanea sativa</i> | + | + | + |
| <i>Chamaecyparis lawsoniana</i> | — | — | + |
| <i>Chamerion angustifolium</i> | + | + | + |
| <i>Chenopodium album</i> | — | + | + |
| <i>Chenopodium polyspermum</i> | — | — | + |
| <i>Circaea lutetiana</i> | — | + | — |
| <i>Cirsium arvense</i> | + | + | + |
| <i>Cirsium vulgare</i> | — | + | + |
| <i>Convolvulus arvensis</i> | + | — | + |
| <i>Conyza canadensis</i> | — | + | + |
| <i>Coronopus didymus</i> | — | — | + |
| <i>Crataegus monogyna</i> | — | + | + |
| <i>Cynara scolymus</i> | — | — | + |
| <i>Dactylis glomerata</i> | + | + | + |
| <i>Daucus carota</i> | — | — | + |
| <i>Deschampsia flexuosa</i> | — | + | — |

| | Heysham Open Space | Oak Hill Wood | The allotment |
|---|-----------------------|------------------|------------------|
| <i>Digitalis purpurea</i> | — | + | — |
| <i>Dipsacus fullonum</i> | — | — | + |
| <i>Elytrigia repens</i> | + | + | + |
| <i>Epilobium ciliatum</i> | + | + | + |
| <i>Epilobium hirsutum</i> | + | + | + |
| <i>Epilobium montanum</i> | + | + | — |
| <i>Epilobium roseum</i> | — | + | — |
| <i>Epilobium roseum</i> × <i>ciliatum</i> | — | + | — |
| <i>Epilobium tetragonum</i> | — | + | + |
| <i>Equisetum arvense</i> | — | — | + |
| <i>Euphorbia peplus</i> | — | — | + |
| <i>Fagus sylvatica</i> | — | + | + |
| <i>Fallopia convolvulus</i> | — | — | + |
| <i>Fallopia japonica</i> | + | + | + |
| <i>Festuca rubra</i> | + | — | + |
| <i>Foeniculum vulgare</i> | — | — | + |
| <i>Fraxinus excelsior</i> | + | + | — |
| <i>Galega officinalis</i> | — | — | + |
| <i>Galium aparine</i> | — | + | + |
| <i>Geranium dissectum</i> | — | + | + |
| <i>Geranium robertianum</i> | — | + | — |
| <i>Geum urbanum</i> | + | + | — |
| <i>Glechoma hederacea</i> | — | — | + |
| <i>Hedera helix</i> | + | + | — |
| <i>Heracleum mantegazzianum</i> | + | — | + |
| <i>Heracleum sphondylium</i> | — | + | + |
| <i>Hieracium</i> sp. | — | + | — |
| <i>Holcus lanatus</i> | + | + | + |
| <i>Holcus mollis</i> | — | + | — |
| <i>Hordeum murinum</i> | — | — | + |
| <i>Hyacinthoides non-scripta</i> | — | + | — |
| <i>Ilex aquifolium</i> | — | + | — |
| <i>Impatiens parviflora</i> | — | + | — |
| <i>Juncus inflexus</i> | — | + | — |
| <i>Laburnum anagyroides</i> | + | — | — |
| <i>Lamium album</i> | + | — | + |
| <i>Lamium purpureum</i> | — | — | + |
| <i>Lapsana communis</i> | + | + | + |
| <i>Lathyrus pratensis</i> | — | + | — |
| <i>Leontodon autumnalis</i> | + | — | + |
| <i>Leucanthemum vulgare</i> | + | — | — |
| <i>Linaria vulgaris</i> | + | — | — |
| <i>Lolium perenne</i> | + | + | + |
| <i>Lonicera periclymenum</i> | — | + | — |
| <i>Lupinus</i> × <i>regalis</i> | — | — | + |
| <i>Malus domestica</i> | — | — | + |
| <i>Malva sylvestris</i> | — | — | + |
| <i>Medicago lupulina</i> | — | + | + |
| <i>Melissa officinalis</i> | — | — | + |
| <i>Mentha</i> × <i>smithiana</i> | — | — | + |
| <i>Mentha spicata</i> | — | — | + |
| <i>Mercurialis annua</i> | — | — | + |
| <i>Mycelis muralis</i> | — | + | — |
| <i>Pastinaca sativa</i> | — | — | + |
| <i>Persicaria maculosa</i> | — | + | + |
| <i>Picris echioides</i> | — | — | + |
| <i>Plantago lanceolata</i> | + | — | — |
| <i>Plantago major</i> | + | + | + |
| <i>Poa annua</i> | + | + | + |
| <i>Poa nemoralis</i> | — | + | — |
| <i>Poa trivialis</i> | — | — | + |
| <i>Polygonum arenastrum</i> | — | + | + |

| | Heysham Open Space | Oak Hill Wood | The allotment |
|---|-----------------------|------------------|------------------|
| <i>Populus</i> × <i>canadensis</i> 'Serotina' | + | — | — |
| <i>Populus</i> × <i>canescens</i> | — | + | — |
| <i>Populus nigra</i> 'Plantierensis' | — | + | — |
| <i>Potentilla reptans</i> | + | + | + |
| <i>Prunella vulgaris</i> | — | — | + |
| <i>Prunus avium</i> | — | + | + |
| <i>Prunus domestica</i> | — | — | + |
| <i>Prunus laurocerasus</i> | — | + | — |
| <i>Pteridium aquilinum</i> | — | + | — |
| <i>Pyrus communis</i> | — | — | + |
| <i>Quercus petraea</i> | — | + | — |
| <i>Quercus robur</i> | + | + | + |
| <i>Ranunculus repens</i> | + | + | + |
| <i>Rhododendron ponticum</i> | — | + | — |
| <i>Ribes nigrum</i> | — | — | + |
| <i>Ribes uva-crispa</i> | — | — | + |
| <i>Rosa canina</i> | — | + | — |
| <i>Rosa</i> sp. | — | — | + |
| <i>Rubus armeniacus</i> | + | + | + |
| <i>Rubus fruticosus</i> agg. | + | + | + |
| <i>Rubus idaeus</i> | — | + | + |
| <i>Rubus laciniatus</i> | — | + | — |
| <i>Rumex obtusifolius</i> | + | + | + |
| <i>Rumex sanguineus</i> | — | + | — |
| <i>Salix alba</i> | — | — | + |
| <i>Salix caprea</i> | — | + | + |
| <i>Salix cinerea</i> | — | + | + |
| <i>Sambucus nigra</i> | + | + | + |
| <i>Senecio erucifolius</i> | + | — | — |
| <i>Senecio jacobaea</i> | — | — | + |
| <i>Senecio squalidus</i> | — | — | + |
| <i>Senecio vulgaris</i> | — | + | + |
| <i>Silene dioica</i> | — | + | + |
| <i>Sinapis arvensis</i> | — | — | + |
| <i>Sisymbrium officinale</i> | — | + | + |
| <i>Solanum dulcamara</i> | — | + | + |
| <i>Solidago canadensis</i> | — | — | + |
| <i>Sonchus asper</i> | — | + | + |
| <i>Sonchus oleraceus</i> | — | — | + |
| <i>Sorbus aucuparia</i> | — | + | — |
| <i>Sorbus intermedia</i> | — | + | — |
| <i>Sorbus latifolia</i> | — | + | — |
| <i>Stachys sylvatica</i> | — | + | — |
| <i>Stellaria graminea</i> | + | — | — |
| <i>Stellaria holostea</i> | — | + | — |
| <i>Stellaria media</i> | + | + | + |
| <i>Symphytum</i> × <i>uplandicum</i> | + | — | — |
| <i>Tanacetum parthenium</i> | + | — | + |
| <i>Taraxacum</i> sp. | + | — | + |
| <i>Taxus baccata</i> | — | + | — |
| <i>Tilia</i> × <i>vulgaris</i> | + | + | — |
| <i>Tragopogon pratensis</i> | — | + | — |
| <i>Trifolium pratense</i> | + | + | + |
| <i>Trifolium repens</i> | + | + | + |
| <i>Tripleurospermum inodorum</i> | — | + | + |
| <i>Tussilago farfara</i> | + | + | — |
| <i>Ulmus procera</i> | — | + | — |
| <i>Urtica dioica</i> | + | + | + |
| <i>Veronica persica</i> | — | — | + |
| <i>Vitis vinifera</i> | — | — | + |

Book review

The book of the spider. From arachnophobia to the love of spiders. Paul Hillyard. Hutchinson, London. 1994. xii, 196 pp. £16. 99. ISBN 0 09 177631 7.

I don't know whether Paul Hillyard has ever suffered from arachnophobia, but at present he seems to be struck with arachnophilia — an overwhelming fascination for arachnids, or more accurately perhaps araneophilia — a love for anything to do with spiders. This includes eating them. He has also combed libraries of old and rare books for any mention of spiders, travelled a good deal to places where strange spiders are to be found and generally enjoyed himself. You might not guess it from the photograph inside the dust-jacket but the brief biographical note gives a clue: Mr Hillyard is quite fanatic. In my experience a lot of the most interesting books are written by people who have taken things a little further than other people; *The book of the spider* is no exception.

Most books on spiders are serious, worthy, scientific and not high on entertainment value: Mr Hillyard has adjusted the balance considerably. He has included some scientific material such as names of spider families and a short history of spider classification, but somehow this part seems somewhat out of place in such a book. He clearly relishes much more some of the outlandish tales of spiders and their doings, and his sometimes hilarious discussion of different forms of arachnophobia, medieval tarantism and other arachno-social phenomena, suggests that he would be a most useful assistant to a film director planning 'Arachnophobia II' or 'Night of the Spider Woman'. It wouldn't surprise me if his next book is about vampires.

Mr Hillyard has collected together an extraordinary variety of opinions and anecdotes about spiders from ancient times to today. He ranges from discussing how spiders survived in space and their possible role in producing bullet-proof vests, to details of exactly how the victims of black widow spiders die. The chapter on tarantism includes eye-witness accounts of sexual excesses of victims to traditional methods of cure on the island of Sardinia — apparently one of the last bastions of this extraordinary affliction.

Unfortunately Mr Hillyard has not been well served by his publisher. His material could benefit from being better organized; as it is there are repetitions (including one large drawing that appears twice, 34 pages apart, and another that appears three times in two sizes). Inaccuracies and minor errors occur, and there is an inconsistent approach to the references. There are also one or two inconsistencies; the 'vivid newspaper report' quoted disparagingly on page 49 sounds fairly restrained when the clinical details are described 15 pages later. There are however some of Mr Hillyard's own excellent colour photographs, though it was some of the other illustrations such as the poster for the film 'Tarantula' and the drawing of the tribesman from New Guinea with his fishing-net made of spiders' webs, that are perhaps more intriguing.

If you suffer an irrational fear of spiders this book may not be for you. However for spider enthusiasts or even general observers of the human condition it has a lot to offer.

J. E. D. MILNER

Changes in the hedgerow landscape of Fryent Country Park, 1983–1993

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Abstract

The hedgerows of Fryent Country Park, Middlesex were resurveyed in 1993 and the results compared with an earlier survey in 1983. The length of hedgerow was estimated to have increased by 21 per cent (1,736 metres), largely as a result of hedgerow restoration and partly by regrowth of vegetation in gaps. The area of hedgerow was estimated to have increased by 30 per cent, though it was more difficult to estimate hedgerow areas than lengths. The number of standard trees had declined by 6 per cent, a net loss of 16 trees. Five of these were lost during the storm of October 1987 and five were lost due to damage during a traveller occupation.

Introduction

The hedgerow landscape of Fryent Country Park, Middlesex was surveyed in 1983 (Williams and Cunnington 1985). Following this survey, Brent Council, with the assistance of local conservation groups, launched a landscape restoration project for the Country Park. The decade was also notable for two major storms, in October 1987 and in early 1990; and locally for a traveller occupation which lasted from 1986 to 1990. In 1993 the hedges were resurveyed to estimate the extent of any changes during the past decade.

Fryent Country Park is a 103-hectare remnant of the countryside of Middlesex, now in the London Borough of Brent. Surrounded by suburban London, bisected by the A4140 Fryent Way and located about 15 km north-west of central London, the Country Park presents a semi-natural landscape, still farmed but generally having escaped intensive agricultural practices. The Park is almost entirely on London Clay, though with pebble gravel capping Barn Hill. The incorporation of the Barn Hill hedges in the landscape scheme designed by Humphry Repton was discussed by Williams, Cunnington and Hewlett (1985). The 1983 survey was later extended to the remnant hedges elsewhere in suburban Kingsbury (Williams, McLauchlin and Harrison 1987), in Wembley and the Brent areas (Williams 1989a). The distribution of the three hawthorn species *Crataegus monogyna*, *C. × media* and *C. laevigata* in local hedgerows was noted by Williams (1989b). Narrow-leaved bitter-cress *Cardamine impatiens*, a nationally scarce plant, was identified in some of the hedgerows in 1985.

Throughout this paper the term hedges has been used collectively to describe hedgerows with a complete shrub component, and remnant hedges with little or no shrub component. Standard trees may occur in both hedgerows and on hedge lines.

Methods

The resurvey used a simplified version of the method used for the 1983 survey (Williams and Cunnington 1985). Since the resurvey was primarily concerned with change, there was no need to re-estimate the age of the hedges, though the tree and shrub species present were recorded. The total length of each hedge and the length of hedgerow were recorded. An estimate was made of the width of each hedge and hedgerow. Standard trees were defined as those which had been grown for, or had grown to a size suitable for, timber (Rackham 1976). The species, number and position of each standard tree was recorded. With the exception of the width estimations and the positions of the standard trees which were not recorded in 1983, all the results could be compared with the earlier survey.

Results

The estimated lengths of the hedges and hedgerows are given in Table 1. In 1983 the total length of hedge within the Country Park was estimated to be 11,210 metres (Williams and Cunnington 1985). Of this 8,184 m was of hedgerow and 3,026 m (27 per cent) was of gaps or of remnant hedges. In 1993 the total length of hedge within the Country Park was estimated as 11,537 m. Of this 9,920 m was of hedgerow and 1,617 m (14 per cent) was considered to be of gaps or remnant hedges. Compared with 1983, these estimates represent an increase of 327 m (3 per cent) in the total length of hedge which probably represents the planting of new hedges; and an increase of 1,736 m (21 per cent) in the length of complete hedgerow. The length of remnant hedge and gaps declined by 1,409 m, or approximately half. Whilst some of the gaps present in 1983 were reduced by vegetation growth by 1993, most of the increase in hedgerow length was due to a policy of planting trees in gaps and replanting some of the remnant hedges.

TABLE 1. Changes in the length (m) of hedges and hedgerow at Fryent Country Park, 1983–1993.

| | 1983 | 1993 | Change |
|---------------|--------|--------|--------|
| Hedgerow | 8,184 | 9,920 | 1,736 |
| Remnant hedge | 3,026 | 1,617 | –1,409 |
| Total | 11,210 | 11,537 | 327 |

The total area of hedge including the herbaceous edge within the Country Park was estimated to be 7.2 hectares in 1983 (Table 2). Although the proportion of this represented by complete hedgerow was not estimated in 1983, the average width of the hedgerows was then estimated to be 7 metres, which would have suggested an area of 5.7 hectares. In 1993 the total area of hedge was estimated to be 7.7 hectares. Of this, 7.4 hectares was of hedgerow and 0.3 hectares of remnant hedges. Where hedgerows had outgrown excessively into adjacent fields, which was particularly a problem with blackthorn *Prunus spinosa*, the width has been controlled by cutting. Most of the hedges now have tractor-mown paths adjacent to their lengths.

TABLE 2. Changes in the area (ha) of hedges and hedgerow at Fryent Country Park, 1983–1993.

| | 1983 | 1993 | Change |
|---------------|------|------|--------|
| Hedgerow | 5.7 | 7.4 | 1.7 |
| Remnant hedge | 1.5 | 0.3 | –1.2 |
| Total | 7.2 | 7.7 | 0.5 |

For standard trees there was a net reduction of 16 trees (6 per cent), from 285 standards in 1983 to 269 in 1993 (Table 3). In total 18 standard trees were lost, but two ash *Fraxinus excelsior* trees were considered to have grown to standard size since 1983. The 1983 total of 285 standards was restated from that given in Williams and Cunnington (1985) to account for standard trees which were then on remnant hedges. Of the 18 trees lost, five (three pedunculate oak *Quercus robur*; one ash and one field maple *Acer campestre*) were lost during a traveller occupation from 1986 to 1990; five were lost during the night-time storm of 15–16 October 1987 (two pedunculate oak, one ash, one field maple and one common pear *Pyrus communis*) and eight (two common oak, three ash, one field maple and two hornbeam *Carpinus betulus*) could not be attributed to a known cause. The rootstock of the common pear survived to promote new growth. The other standard trees recorded were black Italian poplar *Populus canadensis* var. *serotina*, wild cherry *Prunus avium* and wild service *Sorbus torminalis*.

TABLE 3. Changes in the number of hedgerow standard trees at Fryent Country Park, 1983–1993.

| Species | 1983 | 1993 | Loss | Gain | Net loss |
|----------------------|------|------|------|------|----------|
| Pedunculate oak | 226 | 219 | 7 | 0 | 7 |
| Ash | 44 | 41 | 5 | 2 | 3 |
| Field maple | 5 | 2 | 3 | 0 | 3 |
| Hornbeam | 4 | 2 | 2 | 0 | 2 |
| Black Italian poplar | 2 | 2 | 0 | 0 | 0 |
| Common pear | 1 | 0 | 1 | 0 | 1 |
| Crack willow | 1 | 1 | 0 | 0 | 0 |
| Wild cherry | 1 | 1 | 0 | 0 | 0 |
| Wild service | 1 | 1 | 0 | 0 | 0 |
| Totals | 285 | 269 | 18 | 2 | 16 |

Discussion

The results indicated that during the ten years from 1983 to 1993, there had been an increase in hedgerow length, an increase in hedgerow area and a decrease in the number of standard trees. For hedgerow length the increase of 21 per cent (1.7 km) was notable as compared with the considerable loss of hedgerow nationally. Brown (1992) noted that 52,000 km of hedgerows, approximately 10 per cent of the total length, were lost in the United Kingdom between 1984 and 1990, though 26,400 km of new hedges were planted, which would suggest a net loss of about 5 per cent. It was also suggested that in addition to deliberate removal, a lack of long-term management of hedgerows was responsible for some losses. Pittman (1993) resurveyed the trees of the parish of Crockenhill in Kent, in 1992, ten years after a survey in 1982. There the storm of 15–16 October 1987 and deliberate removal by grubbing or felling appeared to be responsible for the majority of the hedgerow standard trees and hedgerows which had been lost since 1982. Some replanting had been undertaken.

Hedgerow and hedge areas are more difficult to estimate than hedgerow lengths, primarily because of problems in demarcating the edge of the habitat. Generally the width would be taken to include shrubs of the hedge plus the herbaceous edge, though the relative proportion of these varied considerably from hedge to hedge. The Fryent Country Park results suggested that the proportional increase in hedgerow area was similar to that for the increase in hedgerow length. As a habitat, hedges and hedgerows occupied approximately 7.5 per cent of the Country Park area.

There was a net loss of 6 per cent of standard trees between 1983 and 1993. The two factors which were responsible for the majority of the loss were a traveller occupation from 1986 to 1990 during which almost an entire hedgerow was lost, and the storm of 15–16 October 1987. The promotion of new standard trees is an aim of the landscape restoration project, though growth may be measured in a time-scale of decades.

The restoration project has been undertaken by Brent Council and by local volunteer groups. The aim has been to restore a hedgerow landscape by restoring all the surviving hedges and hedgerows and by planting new hedges where appropriate. On the east side of the Country Park, corresponding to that part in the former parish of Kingsbury, the All Souls College (1597) map was used as a guide for the restoration. Several thousand trees, many grown in a local nursery from seed collected in the Country Park, have been planted in the hedges. The long grass and herbaceous vegetation in the hedge edges was a suitable habitat for the field vole *Microtus agrestis*, the bark-ringing of which was responsible for a high mortality amongst the trees planted during the early stages of the restoration project. The use of reclaimed plastic containers was found to be as effective as proprietary tree-guards and over 15,000 containers were used (Williams and Northcroft 1994).

Acknowledgements

The hedgerow restoration achieved to date has largely been due to the combined efforts of Brent Council and the volunteers of Barn Hill Conservation Group.

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Nonsuch Park and adjacent open spaces in Ewell, Surrey — some data on the flora and fauna

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Abstract

Nonsuch Park and the adjacent open spaces between Ewell and Cheam in north-east Surrey is almost an oasis of countryside in suburbia. It has an interesting history as the site of a Royal palace and deer park, later farmland, and today the park is a public open space augmented by the adjacent Cherry Orchard Farm and Warren Farm.

Little has been published on its natural history. This paper includes some recollections of twentieth-century land-use, existing records of plants and animals, and the results of field survey work in 1993. It is hoped that this will establish some baseline data and stimulate further records. The discussion considers management and the maintenance of species and habitat diversity.

History of Nonsuch

The story of Nonsuch is told in John Dent's eminently readable book *The quest for Nonsuch*, first published in 1962, a few years after the excavation of Nonsuch Palace. John Dent lived nearby at Ivy Cottage, adjacent to Cherry Orchard Farm, and was Epsom and Ewell Borough Librarian until his death in 1972. His book was reprinted in 1971 and 1981. There is also a pictorial account *Nonsuch: pearl of the realm* by Lalage Lister (John Dent's daughter), published in 1992.

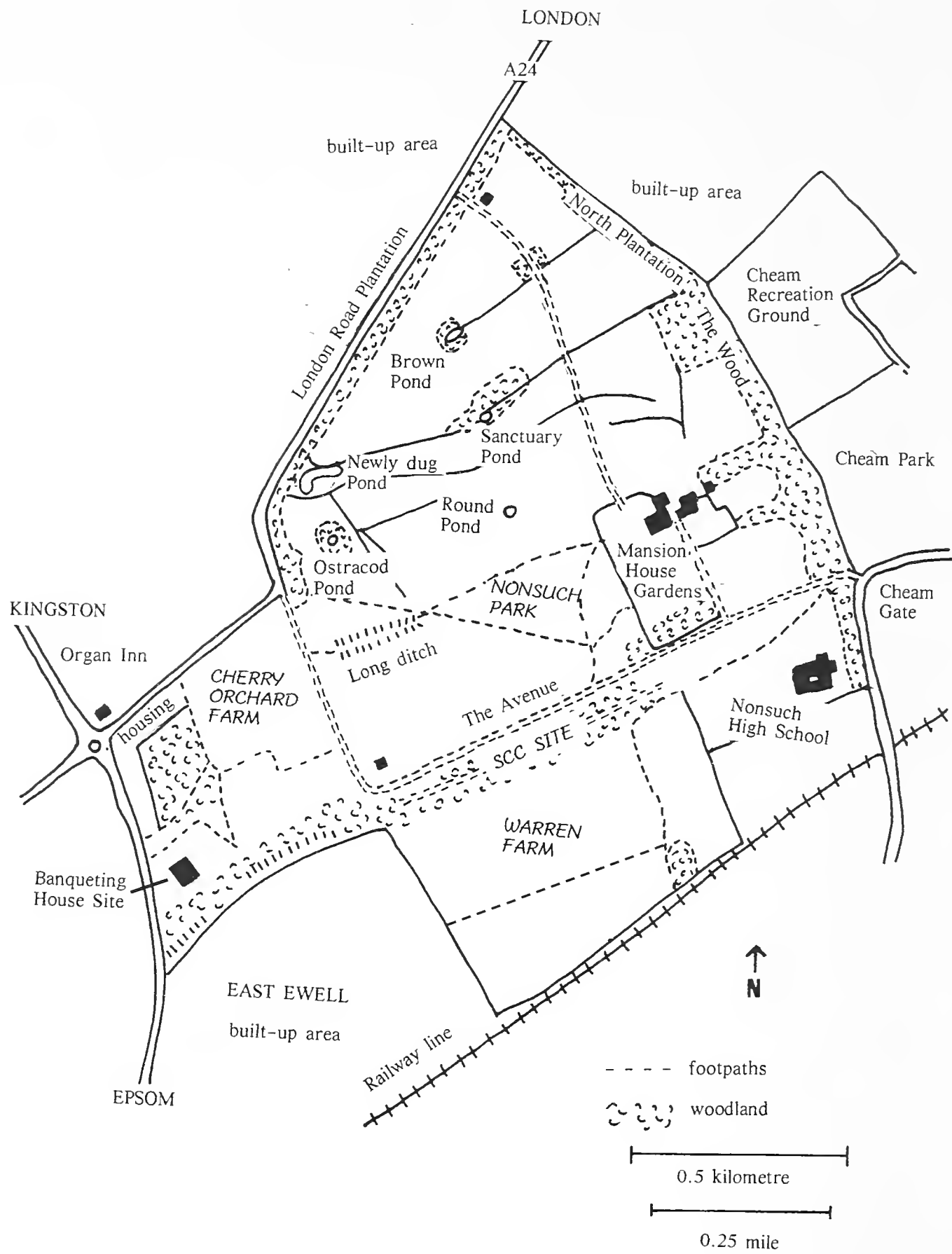


FIG. 1. The Nonsuch sites.

The present Nonsuch Park (Figure 1) is part of the Little Park, a deer park that surrounded Henry VIII's famous Nonsuch Palace which once stood near the Ewell gate. The adjacent Cherry Orchard Farm and Warren Farm were also in the Little Park. Contemporary illustrations (Dent 1981) show deer in the park accompanied by hunting scenes. The fallow deer herd is mentioned in a manuscript 'A survey of Nonsuch House and Park 1650' that is transcribed in the appendix to Dent (1981). In 1670 the palace was granted to Barbara Villiers, Countess of Castlemaine, a mistress of Charles II. In spite of her abundant income, she ran into debt through extravagant living and gambling and there is no evidence of her visiting the palace, which presumably fell into further disrepair. Over a period in the late seventeenth century Nonsuch was disparked

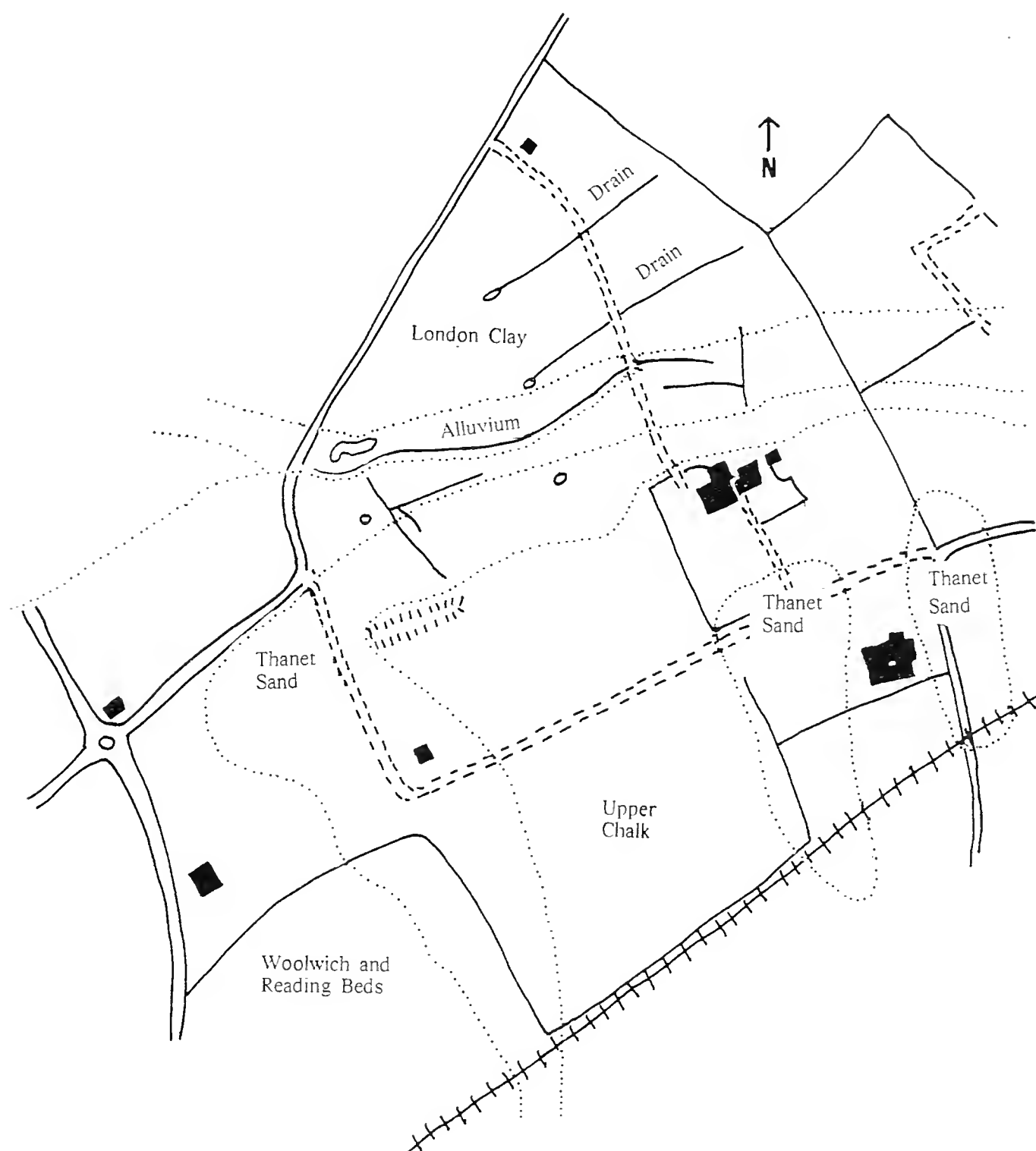


FIG. 2. The geology of Nonsuch.

(removal of the deer and the surrounding fence or pales) and the land was eventually let out to tenant farmers. The palace was demolished starting in the 1680s and sold for its building materials. In 1731 Little Park was bought by Joseph Thompson and the contemporary map (Dent 1981) shows most of the current field pattern then in existence, as well as the development of the gardens around the present-day Mansion House in the centre of the park. The farmhouse of Joseph Thompson was incorporated into the present Mansion House when it was enlarged in the early nineteenth century. The Little Park passed by inheritance until it was sold to Samuel Farmer in 1799 and again it was passed by inheritance through several generations until 1937 when Surrey County Council purchased the house and about 105 hectares (260 acres) surrounding it which formed most of the present Nonsuch Park. Since then it has been under the control of the Nonsuch Park Joint Management Committee. In 1939 the local authorities secured rights of amenity for their residents under a 'Deed of User'.

Until the early 1930s the Little Park was surrounded by similar farmland, but the Great Park (now Worcester Park) and most of Cheam were soon built over. The

beginning of Nonsuch as a public open space and thoughts behind it are summarized in a note in the British Naturalists' Association magazine *Country-Side* in 1934:

'The park, however, is a pleasant place where a genuine flavour of rural England lingers. The cheerful sound of the hay-cutter is still heard in mowing-time in the wide meadows where hares, rabbits and partridges abound. A mile-long avenue of elms — the home of woodpeckers, owls and jackdaws — leads through the park from Cheam to Ewell.

'A determined effort is at present being made by the residents in these districts to secure that the park shall remain as an open space for all time, and it is felt that this movement is worthy of wider than local support...'

Anon. 1934.

The local authorities at the time saw the value of Nonsuch as an open space for the new urbanized rather than village communities. The adjacent Cherry Orchard Farm was purchased by Epsom and Ewell in 1935 and Surrey County Council's purchase included a strip of land between Nonsuch and Warren Farm, parallel to the Avenue.

Further reference to the bird life is given in *A short history of Ewell and Nonsuch* (Willis 1969, originally published 1931) where the author regrets that flocks of plovers in Ewell may not be there much longer due to building. The area was changing.

Wartime came shortly after the establishment of Nonsuch Park as a public amenity and both during the war, and in the decade following, farming continued to take place at Nonsuch. The clay soil was used for cereal crops. Cherry Orchard Farm was rented out as farmland and for market gardening. Warren Farm on the other side of the avenue between the Ewell and Cheam gates was owned by the Greater London Council then the Inner London Education Authority as potential sports ground, but was never used as such and was let out to a tenant farmer. Warren Farm is now in the ownership of developers with the consequent threat of development and the subject of two public inquiries in May 1992 and February 1994. The future of Warren Farm is still (June 1994) in question.

Topography and geology

Nonsuch open space, thirteen miles south of central London, is in the Borough of Epsom and Ewell and bordering Sutton and Cheam in north-east Surrey. The adjacent Cheam Park and recreation ground lie in Sutton and Cheam, but the whole of Nonsuch is used by residents of that borough. Politically Epsom and Ewell come under Surrey County Council, while Sutton and Cheam were included in the Greater London Council area as a London borough. The Nonsuch lands are just outside the brief of the London Wildlife Trust and on the perimeter of the area covered by Surrey Wildlife Trust whose main activities focus south of the built-up area in the more open Surrey countryside. This interstitial position between London and Surrey poses a number of problems for the conservation of Nonsuch open spaces for wildlife and amenity.

Contour lines show the range of height to be between 40 metres (131 ft) and 60 metres (197 ft). There are various changes of slope visible on the ground. The highest area is the chalk of Warren Farm (to 60 metres) which forms a plateau with views around. Another area with views is from the top of the London Clay between the Sparrow Farm and Ewell gates on the London Road, looking towards Epsom Downs, and as one of the 1993 survey team commented 'not a house in sight'.

Nonsuch and the adjacent open spaces includes a range of geology (Figure 2) which affects topography, drainage and natural history, and once influenced the farming use. The geology of Nonsuch is given on the geological map Sheet 270 (Drift) for South London.

Chalk

Chalk of the Cretaceous period occurs in the south-east section of Nonsuch over Warren Farm, Nonsuch High School, the railway line along the boundary and into the south-east corner of Nonsuch and Cheam Parks, including the Mansion House and gardens. The sunken lawn there was once a chalk-pit (Dent 1981). The chalk is sometimes overlain by a sandy soil.

Tertiaries

Sands and clays of the Eocene period occupy the rest of the park. In the northern half of Nonsuch Park, along the London Road (A24) and Cheam Recreation Ground, the land is of heavy London Clay (i³) and in this area there are many drainage ditches. The land slopes down and at the foot is the outcrop of Woolwich and Reading Beds (i²) followed by Thanet Sands (i¹). The western part of Cherry Orchard Farm and the Banqueting House site are on Woolwich and Reading Beds, hence the brick-pits. Strips of Thanet Sands overlay the chalk at the eastern part of Cherry Orchard Farm, the palace site in Nonsuch Park, two areas of Warren Farm, and Nonsuch High School.

The Tertiaries are more acid than the chalk and the clays are of poor drainage.

Superficial deposits

A small strip of more recent alluvium occurs between the outcrops of London Clay and the Woolwich and Reading Beds in the western part of Nonsuch Park on the line of the newly-dug pond.

The difference in geology through the physical conditions and chemistry of the soil has an influence on the distribution of plants and animals. Soil tests were made at Nonsuch in May 1993 using a BDH Indicator kit and they ranged from somewhat acid (pH 6.75) through neutral (pH 7.0) to alkaline (pH 7.5). The chalk gives a calcareous soil.

Habitats

Nonsuch Park, together with the adjacent Warren Farm and Cherry Orchard Farm, occupies a large area (a total of 168 hectares, 416 acres) and a range of habitats and environmental amenities that are much enjoyed and used by the local people.

Grassland

The majority of the area is now grassland (see Frontispiece), although much of it, particularly on the London Clay, had an earlier history of arable use, but with some fields cut for hay. Of the farmland Warren Farm was in cultivation until 1987 and it is relatively unimproved with fertilizers. Farming activities feature strongly in the recollections of Nonsuch from the 1930s – 1950s.

Grassland is present on all of the geological outcrops, so geology as well as previous and present management has an influence on the fauna and flora established.

Woodland

A belt of mixed woodland follows the margin of Nonsuch Park along the London Road (A24) and along the eastern (Cheam) boundary. In the centre of the park on a slope of London Clay is an oval mixed plantation and there are also woodland strips to the south of the Mansion House gardens and along part of the avenue from the Cheam to Ewell gates. There is a further woodland block between Cherry Orchard Farm and the Banqueting House site. In addition to woodland belts are isolated trees, often oaks, typical of a parkland scene (Figure 3). In the days of labour-intensive farming large trees were used for lunchtime shelter and shade by the farm workers (Frank Tait pers. comm.). Smaller strips of trees and shrubs occur alongside drainage ditches and field boundaries and there are many small copses.

The composition of woodland is a mixture of deciduous and coniferous trees with a greater emphasis on deciduous (Figure 4). Oaks *Quercus robur* are important particularly on the clay, but beeches occur on some of the better-drained soils in woods bordering the adjacent Cheam Park and near the Cheam gate. Hawthorn is very common as a shrub or tree and it occurs as a secondary tree layer in woodland belts. English elm *Ulmus procera* used to be a very distinctive part of the Nonsuch landscape, but since the 1970s mature elms have been lost to Dutch elm disease, although some



FIG.3. A typical scene in Nonsuch Park, near The Wood, 1993.

Photo: J. Chatfield

scrub elm persists. The woods in Nonsuch do not have a deep layer of leaf-litter which limits part of the invertebrate fauna. Dead branches, logs and stumps provide valuable habitats in various woods for fungi and invertebrates.

Woodland is the climax vegetation for the country and where open country is not managed or grazed, then succession would proceed through scrub to secondary woodland. The wooded belt along the old concrete road (Surrey County Council strip) is an example of a recently-established woodland.



FIG. 4. Deciduous trees of The Wood on the boundary with Cheam Park, 1993. *Photo: J. Chatfield*



FIG. 5. Willows at the Round Pond, Nonsuch Park, 1993.

Photo J. Chatfield

Wetland

There are a number of drainage ditches of temporary water and four small ponds, three of them in copses of trees and one, the Round Pond shown on maps, in the open, not far from the Mansion House. The willows by the Round Pond are now of substantial size (Figure 5), but a photograph of the pond taken by the author in 1955 shows that it was once much less wooded. A former bomb-crater pond (the 'Snail Pond' of my field notes 1950s – 1962) has now been filled in and the area planted over with trees. In the recent years of drought these ponds have been reported as being dry (Frances Wright pers. comm.), but they all held water during a visit in April 1993, although the Sanctuary Pond and Brown Pond (my names) were dry by the field meetings in May 1993.

A new and larger pond was dug in the 1980s along the line of a drainage channel near the Ewell gate, and it will be interesting to see the establishment of an aquatic flora and fauna as it matures. This is near the site of the 'Great Pond' shown on the 1731 map (Dent 1981). A large pond is remembered at Bluegates (now a housing estate near the Organ Inn), which was well-known to local schoolchildren for its abundant population of newts. It is now very overgrown and next to housing.

Some marshy ground with *Juncus* rushes exists by the Round Pond, but the wetland and marsh habitat is hardly represented in the Nonsuch open space.

Edge habitats

Where land has been under the plough or mown, the native flora and fauna survives in the uncultivated edges of fields, in and under hedgerows, tree-belts along field boundaries, roadways (The Avenue) and footpaths. Long grass and scrub in these places are valuable for many insects, while the greater moisture under the longer vegetation benefits snails, woodlice and harvestmen. These strips also provide shelter, nesting sites and food for mammals and birds. Edge habitats are a valuable part of the environment for wildlife. Ploughing last occurred in Nonsuch at Warren Farm in 1986.

Walls and man-made structures

Some animals and plants which would normally live on natural rock faces find opportunity to establish on walls and buildings of human construction. There are walls around and within the Mansion House grounds that are of particular interest for their mosses, liverworts and lichens, and also for snails, woodlice and other invertebrates.

Recollections of Nonsuch

A number of written recollections have been received from people who remember Nonsuch over the last sixty years. There is only room for extracts here, but they usefully recall the traditional farmed landscape, its wildlife, some of which is now lost, and also the importance which this piece of London's countryside had for the children who grew up with it, shaping their attitudes to countryside and the natural world in a powerful way. Some went on to be biologists or into other careers based on the countryside. Amongst these Nonsuch children was Professor David Bellamy who lived in Cheam as a boy.

Selected extracts from recollections

DR ROBIN MATTOCKS

'The Farm.

'During the war and for several years after much of the park was under cultivation: there were fields of wheat, and also a flock of sheep. In summer the wheat was harvested in bundles and left on the fields in stooks until a huge threshing machine was brought in, operated by land-girls (no combine harvesters then), finally haystacks were made up.

'Trees.

'There were lines of magnificent elm trees in the park until they were devastated by Dutch elm disease.'

Nonsuch also stimulated his interest in photography and a fine example showing the corn stooks of the farming years is used in this paper (Figure 6).



FIG. 6. Stooks at harvest time in Nonsuch Park during the Second World War. *Photo: R. Mattocks*

FRANK TAIT

Frank Tait was brought up in Wickham Avenue, Cheam, bordering Nonsuch Park, and his memories go back to about 1937. He later went on to read agriculture at Wye College. Nonsuch Park and Cherry Orchard Farm provided him with his initial practical experience of farm work.

‘During the war quite large areas of Nonsuch were farmed. I can only remember cereals being grown with a bit of haymaking. The hay in those days was cut, turned until it was dry, raked and then lifted by an elevator into stacks which were then thatched to keep the weather out. Haymaking and corn harvest were labour-intensive operations! Without modern herbicides many of the crops were very weedy and thistles were not well liked by the stooking gang.’

He also refers to catching rabbits in Nonsuch to eke out the meagre wartime meat rations.

‘Looking back Nonsuch gave me and my friends an appreciation and understanding of the countryside that has stayed with us for nearly 60 years... Nonsuch helped develop our views on what we wanted to do in life.’

ROBIN ROBBINS

A natural history writer brought up in the Nonsuch area describes her childhood memories during the war years.

‘I did not know the names of things, but blotted up experiences and filed them until life later handed me their labels.’

Together with her dog she explored the park, listened to the first cuckoo each year and watched pond skaters.

‘Nonsuch helped to mould my interests, feed my curiosity and lead me now to make my living by writing about the natural world.’

DR JUNE CHATFIELD

‘My recollections of the Nonsuch open spaces cover the late 1940s – early 1960s. Nonsuch was still farmed then. The northern part of the park on London Clay was given to cereal growing — wheat, oats and barley — and I remember the traditional corn stooks in fields and also the stacks along the driveway from the Sparrow Farm gate to the Mansion House. Pigs were kept at Cherry Orchard Farm and there were a few sheep by the Mansion House in the immediate post-war years.

‘Partridges were birds to look out for over the cereal fields while rabbits caused damage to plants in the formal gardens. Neither occurs there now. I remember being particularly interested in the pond life and also the birds and making a start on the study of mosses and molluscs.’

FRANCES WRIGHT

Frances Wright lives in Cheam and has known and used Nonsuch all her life. She is currently secretary of the conservation group Nonsuch Watch.

‘This is the area we depend on for our relaxation. Its peace is special to us, so is the wildlife which I have always found extremely rich for such a densely-populated region. Many birds thrive, no doubt as pleased as we are to find this “haven” — the three British woodpeckers, nuthatches, blackcaps (on Cherry Orchard and Warren Farms), skylarks (Warren Farm), yellowhammers, willow-warbler, lesser whitethroat and chiffchaff.

‘I remember Nonsuch Park itself as a much wilder place in the mid and even late 1960s. In the 1970s and 1980s the park underwent a more formal management regime, but this was relaxed in 1991 following an ecologist’s report and recommendations.

‘We feel an ambience of countryside peace and sense of “time standing still” in the more undisturbed parts of Nonsuch.’

The last impression ties in well with the account of Nonsuch in *Country-Side* (Anon. 1934).

Several of those who have been away from Nonsuch for several decades made return visits and it is interesting to read their impressions. One is the greater extent and

thickness of woodland. Richard Fitter, who knew Nonsuch in the 1930s, noticed this along The Avenue and by the site of Nonsuch Palace, and Frank Tait had the impression that the woodland between Nonsuch and Cheam Recreation Ground was more dense and that the old concrete road along the Surrey County Council strip on the border with Warren Farm, then exposed and in the open, was now unrecognizable, as a secondary woodland strip of sycamore trees had engulfed it. Other obvious environmental changes are the loss of mature elms and the end of active farming at Nonsuch.

The last days of farming at Nonsuch (From the notebook of the late Brad Ashby)
 30 January 1984: Warren Farm. Brightly green from newly-sprouting cereal.
 14 December 1985: Warren Farm. The stubble now mostly ploughed.

Previous records

Published records

The literature search is not complete, but so far confirms that little has been published on the flora and fauna of Nonsuch. Some insect records were located in Evans and Evans (1973) and de Worms (1978) (Lepidoptera), and various papers by Groves (1964–86) on Hemiptera which include details of specimens collected at Nonsuch in 1954 and 1955. There is also brief reference to bats (Mickleburgh 1987). Further journals remain to be scanned and the author would be grateful to receive details of any publication referring to the flora and fauna of Nonsuch.

Unpublished records

Work is also in progress assembling unpublished records from naturalists who have visited and recorded from the Nonsuch sites. This information extends over a sixty-year period, so it will be possible to highlight the changes that have taken place and perhaps to suggest factors involved.

FUNGI: Sixteen species of fungi were listed for Nonsuch Park by Peter Holland and Margaret Kennedy in 1989. This list concentrates on specialist groups rather than the more familiar larger mushrooms and toadstools, so further recording is needed.

BRYOPHYTES: A list of mosses and liverworts at Nonsuch made by the late Jack Gardiner between 1973 and 1980 for his bryophyte flora of Surrey (Gardiner 1981) is with the records of the Surrey county recorder for the British Bryological Society, Paul Adams. As these are comparatively recent they have been included in a separate column of the bryophyte list (p. 92).

FLOWERING PLANTS: Forty-one species of flowering plants were listed for Nonsuch Park by Richard Fitter around 1934 (Appendix 2). Other, more recent lists include 161 species recorded by Jean Byatt for Warren Farm in 1988 and 1991, and 29 species, also from Warren Farm by R. Parker, also in 1991. Other previous records of flowering plants were made by the British Naturalists' Association in 1992 and 1993 led by Doris Hutchings. Sixty-two trees, including many exotic ornamental plantings, were recorded by Bryan Radcliffe in the adjacent Cheam Park and Mansion House gardens, Nonsuch at a field meeting of the London Natural History Society in September 1982 (Appendix 1).

MOLLUSCS: Previously-recorded molluscs include 30 species by the author in the 1950s–1962, and some additional species by Martin Willing in the 1960s. Slugs and snails were surveyed again during the 1993 recording meetings.

INSECTS: Of the insect groups, the butterflies are the most completely known, but there are very few records of moths. The late Desmond Seymour recorded 24 species of butterflies for Nonsuch between 1971–93.

PLANT GALLS: Five species of plant gall, four on oak and one on rose, were named by John Ockenden from specimens collected by Frances Wright and Doris Hutchings in 1992, while further records were made during the 1993 survey.

REPTILES AND AMPHIBIANS: Two reptiles, the common lizard and the slow-worm, have been recorded by Frances Wright in recent years from Warren Farm, while Paul Knipe (ecologist to British Rail) confirmed the presence of common lizards on the railway bank along the boundary of Warren Farm.

Amphibians recorded include common toad, common frog and smooth newt. The great crested newt used to be present in the Brown Pond in Nonsuch Park in the 1950s (author).

BIRDS: Birds have been studied by the Surrey Bird Club in 1992 and compiled by Jeffery Wheatley, when 23 breeding species were listed with 22 additional species present — a total of 45. Meetings of the Surbiton and District Birdwatching Society annual new year visit to Nonsuch compiled by Peter Denney in January 1993 and 1994, listed 29 and 28 species respectively. Birds noted on regular visits by local residents, Frances and Jean Wright, in 1987–8 included 30 breeding species and 14 others, a total of 44 for Nonsuch Park, and 35 breeding species and 10 others (total of 45) for Warren Farm. A London Natural History Society bird survey in tetrads T22 and T42 by David Montier (1977) listed 30 breeding species and 17 others, a total of 47. In a list of birds seen at Nonsuch the late Desmond Seymour of Stoneleigh noted 49 species as regulars and four rarities or overfliers. The late Brad Ashby of Cheam extracted some Nonsuch bird records which have been incorporated in the list. Further bird records were obtained from the British Naturalists' Association field meetings led by Doris Hutchings in 1992–3. Other bird records came from Victor Howard.

MAMMALS: Records of mammals at Nonsuch have been obtained by Ian Beames who has lived at West Ewell since 1963. It includes seven species: hedgehog, noctule and pipistrelle bats, grey squirrel, bank vole, woodmouse and fox. In addition molehills have been recorded by Frances and Jean Wright on the sandy soils. Hares, mentioned in the article in *Country-Side* (Anon. 1934), and rabbits, are no longer on the list for Nonsuch.

Field survey meetings, 1993

It was clear that existing information on Nonsuch was neither comprehensive nor always up to date, so a series of field survey days with volunteer specialists was set up by the author (May and October) and Roger Hawkins (June, July and August). Some groups, particularly insects, are highly seasonal and a spread of dates is necessary for an adequate sampling of populations across the animal and plant groups. Some recorders not available on the 1993 survey dates made separate visits.

Recorders were: *Fungi* Mr Peter Holland, Miss Margaret Kennedy and Dr June Chatfield; *Lichens* Mr Frank Dobson; *Bryophytes* Prof. Jeffery Duckett, Mr Roy Hurr and Dr June Chatfield; *Flowering plants* Mr Roger Hawkins and Dr June Chatfield; *Molluscs* Dr June Chatfield, Miss Judith Nelson and Mr Michael Weideli; *Isopods* Dr June Chatfield and Miss Rosemary Hill; *Spiders* Mrs Frances Murphy, Mr Peter Harvey and Miss Rosemary Hill; *Harvestmen* Dr June Chatfield, Miss Rosemary Hill and Mr Ron Boyce; *Insects* Mr Roger Hawkins, Miss Rosemary Hill, Mr Ron Boyce, Mrs Robin Robbins, Mr Peter Harvey and Mr Vic Howard; *Birds* Miss Frances Wright, Mr Vic Howard, Mr Peter Denney and the late Dr Desmond Seymour.

Survey days were held:

2 May 1993: Cold and overcast. A route was walked through Cherry Orchard Farm, Banqueting House, Surrey County Council strip and Warren Farm.

- 16 May 1993:** Cool and breezy with bright spells, but drizzle later. Field work also included Nonsuch Park and particularly the ponds.
- 13 June 1993:** Morning cool and overcast (at newly-dug pond in Nonsuch Park), afternoon sunny and warm (at Warren Farm).
- 4 July 1993:** Very hot and sunny. Newly-dug pond in Nonsuch Park in morning, Cherry Orchard Farm and Warren Farm in afternoon.
- 1 August 1993:** Very hot. Habitats as above.
- 23 August 1993:** Overcast with sunny intervals. Nonsuch High School in morning, Nonsuch Park in afternoon.
- 29 August 1993:** Sunny and warm. Warren Farm and Nonsuch Park.
- 7 October 1993:** Damp and cool with some rain, brighter later. Nonsuch Park, Mansion House gardens, The Wood and Round Pond. Afternoon — Cherry Orchard Farm, Banqueting House and Warren Farm.

Fungi

Most of the fungus records were provided by Peter Holland, from two visits in 1993 and one in 1989, with a few additional ones by June Chatfield.

With some additions, the list mostly follows the Collins New Generation Guide *Fungi of Britain and Europe* (Buczacki 1989).

AGARICALES

Slippery jack *Suillus luteus*: Nonsuch Park, mown grass outside gardens, 51/236636.

Stinking parasol *Lepiota cristata*: Nonsuch Park, London Road Plantation.

Shaggy parasol *L. rhacodes*: Nonsuch Park, London Road Plantation and between gardens and Long Ditch.

Deceiver *Laccaria laccata*: Nonsuch Park, 51/228637.

Clitocybe dealbata: Nonsuch Park, mown grass outside gardens, 51/236636.

Tawny funnel cap *C. flaccida*: Nonsuch Park, 7.x.1993 (J. Chatfield).

Wood blewit *Lepista nuda*: 28.i.1989, region not specified.

Tricholoma scalpturatum (= *argyraceum*): Surrey County Council strip.

Honey fungus *Armillaria mellea*: Cherry Orchard Farm, 7.x.1993 (J. Chatfield).

Clustered tough shank *Collybia confluens*: Surrey County Council strip.

C. erythropus: Nonsuch Park, London Road Plantation.

Wood woolly foot *C. peronata*: Surrey County Council strip.

Fairy ring mushroom *Marasmius oreades*: Nonsuch Park.

Mycena galopus: Nonsuch Park, 7.x.1993 (J. Chatfield); London Road Plantation.

M. olivaceomarginata: Nonsuch Park, mown grass outside gardens, 51/263636.

Hemimycena mairei: Nonsuch Park, mown grass outside gardens, 51/236636.

Velvet shank *Flammulina velutipes*: 28.i.1989, area not specified; Nonsuch Park, London Road Plantation.

Inocybe geophylla: Nonsuch Park, London Road Plantation.

Poison pie *Hebeloma crustuliniforme*: Surrey County Council strip.

Crepidotus variabilis: Nonsuch Park, London Road Plantation.

Tubaria autochthona: Surrey County Council strip.

Yellow cow-pat toadstool *Bolbitius vitellinus*: Nonsuch Park.

Agaricus arvensis: Nonsuch Park.

Field mushroom *A. campestris*: Nonsuch Park, mown grass outside gardens, 51/236636.

Sulphur tuft *Hypholoma fasciculare*: Nonsuch Park, 7.x.1993 (J. Chatfield).

Verdigris agaric *Stropharia aeruginosa*: Nonsuch Park; Cherry Orchard Farm, 7.x.1993 (J. Chatfield); Banqueting House, 7.x.1993 (J. Chatfield).

Common ink cap *Coprinus atramentarius*: Banqueting House, 7.x.1993 (J. Chatfield).

Glistening ink cap *C. micaceus*: Nonsuch Park, London Road Plantation.

C. plicatilis: Nonsuch Park, mown grass outside gardens, 51/236636.

Weeping widow *Lacrymaria velutina*: Nonsuch Park, grassland by Ewell gate, 7.x.1993 (J. Chatfield).

APHYLLOPHORALES

Zoned polypore *Coriolus versicolor*: Nonsuch Park, 7.x.1993 (J. Chatfield).

Pseudotrametes gibbosa: Nonsuch Park, London Road Plantation.

Blushing bracket *Daedaliopsis confragosa*: Nonsuch Park, London Road Plantation.

Birch bracket: *Piptoporus betulinus*: Cherry Orchard Farm, woodland, 7.x.1993 (J. Chatfield).

Dryad's saddle *Polyporus squamosus*: Nonsuch Park, Cherry Orchard Farm, woodland, 2.v.1993 (J. Chatfield).

Bjerkandera adusta: 28.i.1989, region not specified; Nonsuch Park, London Road Plantation.

Giant polypore *Meripilus giganteus*: Nonsuch Park.

Stereum hirsutum: 28.i.1989, region not specified; Nonsuch Park, London Road Plantation.

Silver leaf *Chondrostereum purpureum*: 28.i.1989, region not specified; Nonsuch Park, London Road Plantation; Cherry Orchard Farm, woodland, 7.x.1993 (J. Chatfield).

Byssomerulius corium: Nonsuch Park, London Road Plantation.

'TREMELLALES' — jelly fungi

Dacrymyces stillatus: 28.i.1989, region not specified, Nonsuch Park, London Road Plantation.

Calocera cornea: Nonsuch Park, London Road Plantation; Cherry Orchard Farm, woodland, 7.x.1993 (J. Chatfield).

Exidia thuretiana: Nonsuch Park, London Road Plantation.

Myxarium nucleatum: Nonsuch Park, London Road Plantation.

Jew's ear *Auricularia auricula-judae*: 28.i.1989, region not specified; Nonsuch Park, London Road Plantation; Surrey County Council strip.

A. mesenterica: Nonsuch Park, London Road Plantation.

UREDINALES — rusts

Cumminsia mirabilissima on *Mahonia*: 28.i.1989, region not specified; Nonsuch Park.

Puccinia caricina var. *ribesii-pendulae* on *Carex pendula*: Nonsuch Park, London Road Plantation.

P. malvacearum on *Malva sylvestris*: Nonsuch Park.

P. menthae on *Mentha aquatica*: Nonsuch Park, by newly-dug pond.

P. punctiformis on *Cirsium arvense*: Nonsuch Park.

Phragmidium violaceum on *Rubus* sp.: Nonsuch Park, by newly-dug pond.

Melampsora caprearum on *Salix caprea*: Surrey County Council strip.

ASCOMYCETES**ERYSIPHALES — powdery mildews**

Erysiphe depressa on *Arctium* sp.: Nonsuch Park.

E. heraclei on *Heracleum sphondylium*: Nonsuch Park.

E. polygoni on *Polygonum aviculare*: Nonsuch Park, by newly-dug pond.

Microsphaera alphitoides on *Quercus*: Nonsuch Park, by newly-dug pond; Surrey County Council strip.

HYPOCREALES

Ergot *Claviceps purpurea* on *Lolium perenne*: Nonsuch Park, by newly-dug pond.

Coral-spot *Nectria cinnabarina*: 28.i.1989, region not specified; Nonsuch Park, London Road Plantation.

SPHAERIALES

Hypoxylon rubiginosum: 28.i.1989, region not specified.

Cramp balls/King Alfred's cakes *Daldinia concentrica*: Nonsuch Park, London Road Plantation; 7.x.1993 (J. Chatfield).

Candle snuff *Xylaria hypoxylon*: Nonsuch Park, London Road Plantation; Cherry Orchard Farm, woodland, 7.x.1993 (J. Chatfield).

Dead men's fingers *X. polymorpha*: Nonsuch Park, London Road Plantation; 7.x.1993 (J. Chatfield).

Tar spot *Rhytisma acerinum*: on sycamore leaves: Nonsuch Park, London Road Plantation.

Orbilia leucostigma: Nonsuch Park, London Road Plantation.

Trochila ilicina on *Ilex*: 28.i.1989, region not specified.

Black bulgar/bachelor's buttons *Bulgaria inquinans*: 28.ii.1989, region not specified.

Bisporella citrina: Nonsuch Park, London Road Plantation.

Platychora ulmae on *Ulmus*: Nonsuch Park, London Road Plantation.

GASTEROMYCETES

Wood puff ball *Lycoperdon pyriforme*: 28.i.1989, region not specified; Nonsuch Park, London Road Plantation.

Vascellum pratense: Nonsuch Park, mown grass by gardens, 51/236636.

USTILAGINALES — smuts

Ustilago violacea on *Stellaria graminea*: Nonsuch Park, by newly-dug pond.

HYPHOMYCETES

Alterneria tenuissima on *Salix caprea*: Surrey County Council strip.

MYXOMYCETES — slime moulds

LICEALES

Dictydiaethalium plumbeum: 28.i.1989, region not specified; Nonsuch Park, London Road Plantation.

TRICHIALES

Arcyria incarnata: 28.i.1989, region not specified.

Trichia decipiens: 28.i.1989, region not specified.

T. varia: Nonsuch Park, London Road Plantation.

PHYSARALES

Physarum nutans: Nonsuch Park, London Road Plantation.

It is difficult to comment on fungi found on only a few visits and clearly more field work would greatly increase the species list, especially of the larger fungi, as Peter Holland has concentrated on the rusts, mildews and slime moulds. The author's records added were incidental to the recording of other groups.

Nonsuch offers both woodland and grassland, habitats which have their own assemblages of fungi. Thirty-four species were listed from the London Road Plantation and less than half that number for the other grassland sites. Although autumn is the season when the majority of fungi fruit, there are some species to be found in most months of the year. Many of the dead-wood fungi are tougher and persist for long periods. For the more seasonal species the timing of the visit by season and weather conditions is important when seeking the maximum numbers of species. For much of the year most fungi live invisibly as a fungal mycelium below ground, coming above the surface only to fruit and distribute spores. Some of the species on the list — *Armillaria mellea*, honey fungus and *Clitocybe flaccida*, the tawny funnel cap — are typically autumn species. Sometimes a species appears in profusion, and Peter Holland noted the great abundance of *Tubaria autochthona* in September 1993 which had previously been found in lower numbers. It occurs under hawthorn and is often on mummified haws.

Again with fungi the habitat needs to be carefully and sensitively managed to maintain the species diversity, leaving herbage, dead wood and fallen leaves to decay naturally *in situ*. The Myxomycetes (slime fungi), most of the Aphyllorales and many of the Ascomycetes and jelly fungi, are dependent on these habitats as well as are the agarics. Some fungi associate with root systems of particular trees, their leaf litter, or items like pine cones and beechmasts.

Whilst a good number of fungi live in woods, others occur in grassland where the management can influence what is found. Some occur on lawns and close-mown grass, presumably the species which elsewhere would occur in grazed grassland. The absence of pasture animals limits the dung flora at Nonsuch. Some of the smaller fungi are pest

species, but tend to occur where the host species is present. Ergots were found on the perennial rye grass, *Lolium perenne*, but they will associate with other grasses. The honey fungus *Armillaria mellea* can be edible when collected very young and thoroughly cooked to destroy toxins (Holland 1990). It is a harmful parasite causing much destruction of trees.

Lichens

Lichens were studied by Mr Frank Dobson on 28 May 1993 and observations confined to Nonsuch Park following a route along The Avenue from the Ewell gate to the Mansion House, the walls of the garden, willows by the Round Pond, the oak plantation just to the north, and back along field boundaries to the new pond and car-park. Reporting on the lichen flora he writes:

‘It is an interesting area with a range of habitats, mainly nutrient enriched, and with the epiphytes showing the effects of the lower SO₂ levels now found in the region. At the same time *Lecanora conizaeoides* is common and *Foraminella ambigua* was found on a chestnut tree in The Avenue. This species has spread from its nineteenth-century habitat in Scotland, where it is found on conifers, to the rest of Britain with the increase in air pollution. It is now becoming rarer in Surrey as the SO₂ levels drop.

‘There are a number of seats in the park made from split logs and these are already starting to gain a lichen flora including *Lecanora expallens*, *L. muralis* and *Buellia punctata*. As long as these seats are not treated with preservative they should, in time, have an interesting flora.

‘I did not have time to look at the mansion but the wall had a very interesting flora. It is rich in *Cladonia* species including *C. pyxidata*, *C. chlorophaea*, *C. coniocraea*, *C. fimbriata* and *C. squamosa*. In one place on the wall they were parasitized by the lichen *Diploschistes muscorum*. Ivy growing on the wall had *Physconia grisea* and was the only site found for *Diploicia canescens*. A less common host is a fig tree which was the site for *Physcia tenella* and *Buellia punctata*. Other species found on the wall were *Acrocordia salwayi*, *Caloplaca citrina*, *Lecanora albescens*, *L. dispersa*, *Leptoloma vouauxii*, *Lecidella scabra*, *Porpidia tuberculosa*, *Psilolechia lucida*, *Verrucaria nigrescens*, *Xanthoria elegans*.

‘The willow trees with their water-retaining and rather basic bark proved to be one of the best sites for lichens. The trees at the Round Pond were examined and a number of *Parmelia* species were found. These were *Parmelia caperata*, *P. revoluta*, *P. subaurifera* and *P. sulcata*. If this site is similar to others in the area it is probable that these species have only returned to the park in the last few years and it will be interesting to monitor these trees in the future. Only a few small thalli of *Hypogymnia physodes* were found; this is normally one of the most pollution-resistant species (in hot dry climates it is very pollution sensitive). On the more acid bark of a nearby oak *Xanthoria candelaris* was noted.

‘The dense woodland almost completely lacks a lichen flora with *Lepraria incana* being the only species noted.

‘In unpolluted areas, old ash and oak trees standing in the open parkland usually have a very rich lichen flora but here they are exposed to the air pollution and they are virtually free from lichens.

‘The species present in the park are similar to those found in other large local open areas such as Richmond Park. Nonsuch Park has a good range of habitats and, no doubt, a longer visit would produce a number of additional species.’

Parkland trees which are well lit are often good for lichens, but this is most often the case when the surrounding grassland is grazed and the tree bark nutrient-enriched from animal droppings. When farmed Nonsuch Park was largely arable and livestock kept were of limited extent around the Mansion House. The limited epiphytic flora was also noted in the report on bryophytes.

It is interesting to see that the lichen flora of Nonsuch may even be improving following from beneficial effects of the Clean Air Act. In the 1950s the area of Ewell and Cheam was within the orbit of dense London smog, for coal was then the normal method of heating homes. Firstly the Clean Air Act and advocating the use of smokeless fuels, and now the general use of oil, gas and electricity ensure cleaner air than once prevailed.

Lichen species found at Nonsuch Park, Ewell, Surrey on 28 May 1993

Due to the state of flux in lichen classification, this list, as most in recent textbooks on lichens, is presented in alphabetical rather than taxonomic order.

| | |
|---------------------------------|------------------------------|
| <i>Acrocordia salweyi</i> | <i>Lepraria incarna</i> |
| <i>Buellia punctata</i> | <i>Leproloma vouauxii</i> |
| <i>Caloplaca citrina</i> | <i>Micarea prasina</i> |
| <i>Candellariella reflexa</i> | <i>Parmelia caperata</i> |
| <i>Cladonia chlorophaea</i> | <i>P. revoluta</i> |
| <i>C. coniocraea</i> | <i>P. subaurifera</i> |
| <i>C. fimbriata</i> | <i>P. sulcata</i> |
| <i>C. pixidata</i> | <i>Physconia grisea</i> |
| <i>C. squamosa</i> | <i>Physcia adscendens</i> |
| <i>Diploicia canescens</i> | <i>P. tenella</i> |
| <i>Diploschistes muscorum</i> | <i>Psilolechia lucida</i> |
| <i>Evernia prunastri</i> | <i>Porpidea tuberculosa</i> |
| <i>Foraminella ambigua</i> | <i>Ramalina farinacea</i> |
| <i>Hyperphyscia adglutenata</i> | <i>Rinodina sophodes</i> |
| <i>Hypogymnia physodes</i> | <i>Verrucaria nigrescens</i> |
| <i>Lecanora albescens</i> | <i>Xanthoria elegans</i> |
| <i>L. chlarotera</i> | <i>X. candelaris</i> |
| <i>L. conizaeoides</i> | <i>X. parietina</i> |
| <i>L. dispersa</i> | <i>X. polycarpa</i> |
| <i>L. expellans</i> | |
| <i>L. muralis</i> | |
| <i>L. scabra</i> | |

Bryophytes

The listed species of mosses and liverworts were found during a visit to Nonsuch on 16 May 1993 by Professor J. G. Duckett and E. R. Hurr and a few additional records by Dr June Chatfield on various dates in 1993. Names are from *The moss flora of Britain and Ireland* by A. J. E. Smith (1978) and *The liverworts of Britain and Ireland* by A. J. E. Smith (1990). The first two columns are from Nonsuch Park (NP) and Cherry Orchard Farm (COF).

'The richest area was probably the old brickearth workings in Cherry Orchard Farm where a secondary woodland has now developed. *Hennediella macrophylla* grows here in some quantity in earth kept open by walkers and particularly by children playing on the steep slopes. This plant is an alien, probably from New Zealand, and the British distribution is around the Thames and Tweed Valleys: this is not a new Surrey record, but it is a new location for an interesting plant (Blockeel, 1990).

Corticolous (i.e. tree-bark) species were not common. Even such normally frequent species as *Hypnum cupressiforme* and *Dicranoweisia cirrata* had to be searched for. The reasons for this are not immediately clear: no doubt Nonsuch has a dry microclimate, but the total species count of 55 on the May 1993 survey day suggests that pollution may not be a factor.'

Roy Hurr

In a separate, third column, are listed the unpublished records of Jack Gardiner from 'Nonsuch Park' (51/23-63-) from 1973-1980.

| Mosses and liverworts | Fieldwork, 16 May 1993 | | Gardiner 1973–1980 |
|-------------------------------|------------------------|-----|-----------------------|
| | Sites | | |
| | NP | COF | |
| MOSESSES | | | |
| <i>Polytrichum formosum</i> | | | + |
| <i>P. juniperinum</i> | + | | + |
| <i>Atrichum undulatum</i> | + | + | |
| <i>Ceratodon purpureus</i> | + | + | + |
| <i>Dicranella heteromalla</i> | | + | + |
| <i>Dicranoweisia cirrata</i> | + | | |

| Mosses and liverworts | Fieldwork, 16 May 1993 | | Gardiner 1973–1980 |
|---|------------------------|-----|-----------------------|
| | Sites | | |
| | NP | COF | |
| <i>Campylopus introflexus</i> | + | | |
| <i>Fissidens viridulus</i> | | | + |
| <i>F. incurvus</i> | | + | |
| <i>F. bryoides</i> | | + | |
| <i>F. taxifolius</i> | | + | + |
| <i>Tortula ruralis</i> ssp. <i>ruralis</i> | | + | + |
| <i>T. intermedia</i> | | | + |
| <i>T. muralis</i> | + | + | + |
| <i>Hemmediella macrophylla</i> | | + | |
| <i>Phascum cuspidatum</i> | | + | + |
| <i>Barbula convoluta</i> var. <i>commutata</i> | | + | + |
| <i>B. convoluta</i> var. <i>convoluta</i> | | + | + |
| <i>B. unguiculata</i> | | + | + |
| <i>B. hornschruchiana</i> | | + | |
| <i>B. revoluta</i> | + | | + |
| <i>B. fallax</i> | + | + | |
| <i>B. trifaria</i> | | | + |
| <i>B. tophacea</i> | | + | |
| <i>B. vinealis</i> | + | | |
| <i>B. cylindrica</i> | + | | |
| <i>Gyroweisia tenuis</i> | | + | |
| <i>Schistidium apocarpum</i> | + | | + |
| <i>Grimmia pulvinata</i> | + | + | + |
| <i>Funaria hygrometrica</i> | | + | + |
| <i>Orthodontium lineare</i> | | | + |
| <i>Polilia nutans</i> | | | + |
| <i>P. carnea</i> | | + | |
| <i>Bryum capillare</i> | + | + | + |
| <i>B. flaccidum</i> | + | | |
| <i>B. caespiticium</i> | | | + |
| <i>B. bicolor</i> agg. | + | | + |
| <i>B. argenteum</i> | + | + | + |
| <i>B. ruderae</i> | | | + |
| <i>B. microerythrocarpum</i> | | | + |
| <i>B. rubens</i> | + | | + |
| <i>Mnium hornum</i> | | + | + |
| <i>Rhizomnium punctatum</i> | | + | |
| <i>Plagiomnium affine</i> | | | + |
| <i>P. undulatum</i> | | | + |
| <i>Orthotrichum affine</i> | + | + | |
| <i>O. anomalum</i> | | + | |
| <i>O. diaphanum</i> | | + | |
| <i>Amblystegium serpens</i> | + | + | + |
| <i>A. riparium</i> | + | | |
| <i>Calliergon cuspidatum</i> | | + | + |
| <i>Homalothecium sericeum</i> | + | + | + |
| <i>Brachythecium albicans</i> | | + | + |
| <i>B. rutabulum</i> | + | + | + |
| <i>B. velutinum</i> | | | + |
| <i>Pseudoscleropodium purum</i> | | + | + |
| <i>Rhynchostegium murale</i> | | + | |
| <i>R. confertum</i> | + | + | + |
| <i>Eurhynchium pumilum</i> | | + | |
| <i>E. praelongum</i> | + | + | + |
| <i>E. swartzii</i> | | | + |
| <i>Plagiothecium undulatum</i> | | + | |
| <i>Isopterygium elegans</i> | | | + |
| <i>Hypnum cupressiforme</i> var. <i>cupressiforme</i> | + | + | + |
| <i>H. jutlandicum</i> | + | | |
| <i>Rhytidiadelphus squarrosus</i> | + | | + |

| Mosses and liverworts | Fieldwork, 16 May 1993 | | Gardiner 1973–1980 |
|---------------------------------|------------------------|-----|-----------------------|
| | Sites | | |
| | NP | COF | |
| LIVERWORTS | | | |
| <i>Cephaloziella divaricata</i> | + | | |
| <i>Lophocolea bidentata</i> | | | + |
| <i>L. heterophylla</i> | | + | + |
| <i>Radula complanata</i> | | + | |
| <i>Porella platyphylla</i> | + | | + |
| <i>Lunularia cruciata</i> | + | | + |

Higher plants

A total of 264 species of higher plants was recorded for the Nonsuch sites from 1988 with 104 for Nonsuch Park, 50 from Cherry Orchard Farm and 201 from Warren Farm. The most intensively-studied area was Warren Farm in view of the public inquiries: more field work could usefully be undertaken on the higher plants at Nonsuch Park and Cherry Orchard Farm. The strong influencing factors on the flora appear to be geology and the recent and past land-use, with the south-eastern location providing a limited rainfall. The latter explains the very low numbers and variety of ferns and horsetails which are more abundant and varied in the south-west of the country. Although additional species are expected from future field work for Nonsuch Park and Cherry Orchard Farm a good number of those listed for Warren Farm may not be found on the other sites or found only in low density and less vigour.

It is now some thirty years since Nonsuch Park was farmed, since when there has been no ploughing and the grass mowing managed in a different way. The most recently farmed land was at Warren Farm, last ploughed in 1986. Some fields at Nonsuch have a long history of hay meadow use (see recollections page 000), and these would be expected to have a richer wild flower component, e.g. ox-eye daisy and the range of grass species, but the amenity mowing regime in the recent past has led to meadows being cut before they come into flower, in one year just as the ox-eye daisies were in bud (F. Wright and others pers. comm.). This not only deprives visitors of the amenity value of ox-eye daisies and other wild flowers, but with annuals cuts off the seed supply. With repeated over-mowing the flora quickly becomes depleted and its composition changes: this is one of the major dangers of amenity mowing (Hare 1992).

The edge vegetation between fields, rows of hawthorns and varied vegetation height by paths, provides a valuable and less-managed habitat for wayside species and especially on chalk at Warren Farm where there is a greater species potential.

The wilder areas of Warren Farm have a flora strongly influenced by the chalk and the open and more recently farmed use of the site. Various recorders commented in its distinctiveness and species richness, and with arable weeds that are being eliminated from the working countryside. There is also a strong non-native element to the Warren Farm list (Canadian golden rod, Michaelmas daisy) partly due to colonization by seed of opportunist species from neighbouring gardens finding bare ground, and perhaps in some instances, to deposition of garden waste.

Richard Fitter’s list of flowering plants made about 1934 includes a number of arable weeds and also species of chalkland, some of which are not on the current list. These are presented in Appendix 2.

Although the shelter tree-belts and small plantations have been present at Nonsuch for two or three centuries, they are not sufficiently old to have developed a woodland flower layer, but there is a good range of native trees and shrubs.

The only wetland flora is at Nonsuch Park by the Round Pond and the newly-dug pond by the Ewell gate, where introductions may have been made following pond construction.

The higher plant flora of the Nonsuch sites is sufficiently diverse to provide much amenity interest in the flowers, trees and the landscape they create, and also

educational opportunities in biology for local schools and young peoples' groups, e.g. scouting and guiding movements.

In the list which follows, only native and naturalized plants are included. Exotic trees from Nonsuch Park and Cheam Park are given in Appendix 1.

The classification and nomenclature follow that of the *New flora of the British Isles* (Stace 1991).

This is an interim report and much survey work needs to be done to extend coverage of all the Nonsuch open spaces in addition to Warren Farm which was surveyed by Dr Jean Byatt on 18 September 1988 and 12 May 1991 in connection with the planning proposals and public inquiry. This information has been incorporated in the list below. The trees of Nonsuch also merit further study. The records are made by the author unless otherwise stated. They also incorporate records made by Miss Doris Hutchings, the Misses Frances and Jean Wright, Mr Roger Hawkins and Mr Ben Dewhurst for the Trust for Urban Ecology.

PTERIDOPHYTES

Field horsetail *Equisetum arvense*: Warren Farm. 1988–91 (J. Byatt).

Male fern *Dryopteris filix-mas*: Warren Farm. 1988–91 (J. Byatt).

GYMNOSPERMS

Scots pine *Pinus sylvestris*: Warren Farm. 1988–91 (J. Byatt).

Yew *Taxus baccata*: Nonsuch Park. 29.viii.1993; Warren Farm. 1988–91 (J. Byatt).

DICOTYLEDONS

White water-lily *Nymphaea alba*: Nonsuch Park (newly-dug pond). 25. vi. 1993.

Meadow buttercup *Ranunculus acris*: Nonsuch Park. 25.vi.1993, 12.vi.1994; Cherry Orchard Farm 24.iv.1993 (D. Hutchings); Banqueting House. 2.v.1993. 16.v.1993; Warren Farm 1988 (F. and J. Wright), 1988–91 (J. Byatt). 12.vi.1994.

Creeping buttercup *R. repens*: Nonsuch Park. 25.vi.1993; Cherry Orchard Farm 24.iv.1993 (D. Hutchings), 12.vi.1994; Banqueting House. 2.v.1993; Warren Farm 1988–91 (J. Byatt). 12.vi.1994.

Bulbous buttercup *R. bulbosus*: Cherry Orchard Farm. 24.iv.1993 (D. Hutchings). 2.v.1993; Warren Farm. 1988–91 (J. Byatt).

Goldilocks *R. auricomus*: Cherry Orchard Farm. 24.iv.1993 (D. Hutchings).

Greater spearwort *R. lingua*: Nonsuch Park (newly-dug pond). 25.vi.1993.

Lesser celandine *R. ficaria*: Nonsuch Park. 4.iv.1993; Cherry Orchard Farm. 24.iv.1993 (D. Hutchings); Warren Farm. 1988 (F. and J. Wright). 1988–91 (J. Byatt).

Water-crowfoot *Ranunculus* sp.: Nonsuch Park. 15.iv.1993. 16.v.1993 (Round Pond).

Common or field poppy *Papaver rhoeas*: Warren Farm. 1988 (F. and J. Wright). 1988–91 (J. Byatt), 5.ix.1992 (D. Hutchings), 13.vi.1993 (F. Wright and R. Hawkins).

Long-headed poppy *P. dubium*: Warren Farm. 1991 (R. Parker).

Greater celandine *Chelidonium majus*: Nonsuch Park. 24.iv.1993 (D. Hutchings).

Wych elm *Ulmus glabra*: Warren Farm. 1988–91 (J. Byatt).

English elm *U. procera*: Nonsuch Park. 2.v.1993; Cherry Orchard Farm. 2.v.1993; Warren Farm. 1988–91 (J. Byatt), 2.v.1993 (railway bank). 12.vi.1994; Nonsuch High School. 23.viii.1993.

Stinging nettle *Urtica dioica*: Nonsuch Park. 25.vi.1993; Cherry Orchard Farm. 2.v.1993. 12.vi.1994; Warren Farm. 1988–91 (J. Byatt). 16.v.1993. 12.vi.1994; Nonsuch High School. 23.viii.1993.

Pellitory-of-the-wall *Parietaria judaica*: Nonsuch Park (Mansion House). 28.viii.1993.

Walnut *Juglans regia*: Surrey County Council strip. 28.viii.1993.

Beech *Fagus sylvatica*: Nonsuch Park. 29.viii.1993; Warren Farm. 1988–91 (J. Byatt).

Sweet chestnut *Castanea sativa*: Nonsuch Park. 29.viii.1993.

Turkey oak *Quercus cerris*: Nonsuch Park. 28.ix.1993; Surrey County Council strip. 28.ix.1993; Warren Farm. 1988–91 (J. Byatt).

Evergreen oak *Q. ilex*: Banqueting House. 2.v.1993; Nonsuch High School. 23.viii.1993.

Pedunculate or English oak *Q. robur*: Nonsuch Park. 28.viii.1993. Surrey County Council strip. 28.viii.1993; Warren Farm. 1988–91 (J. Byatt).

- Silver birch** *Betula pendula*: Cherry Orchard Farm, 7.x.1993 (J. Chatfield); Warren Farm, 1988–91 (J. Byatt).
- Hornbeam** *Carpinus betulus*: Cherry Orchard Farm, 2.v.1993.
- Fat-hen** *Chenopodium album*: Warren Farm, 1988–91 (J. Byatt).
- Common orache** *Atriplex patula*: Warren Farm, 5.ix.1992 (D. Hutchings).
- Thyme-leaved/slender sandwort** *Arenaria serpyllifolia leptoclados*: Warren Farm, 1988–91 (J. Byatt).
- Common chickweed** *Stellaria media*: Nonsuch Park, 25.vi.1993; Warren Farm, 1988–91 (J. Byatt).
- Greater stitchwort** *S. holostea*: Nonsuch Park, 1988 (F. and J. Wright), 25.vi.1993; Cherry Orchard Farm, 24.iv.1993 (D. Hutchings); Warren Farm, 1988 (F. and J. Wright).
- Lesser stitchwort** *S. graminea*: Nonsuch Park, 25.vi.1993, 12.vi.1994; Banqueting House, 16.v.1993; Warren Farm, 5.ix.1992 (D. Hutchings); Nonsuch High School, 23.viii.1993.
- Common mouse-ear** *Cerastium fontanum holosteoides*: Nonsuch Park, 12.vi.1994; Cherry Orchard Farm, 12.vi.1994; Warren Farm, 5.ix.1992 (D. Hutchings), 12.vi.1994.
- Pearlwort** *Sagina* sp. cf. *procumbens*: Nonsuch Park (Mansion House), 28.viii.1993.
- Bladder campion** *Silene vulgaris*: Warren Farm, 1991 (R. Parker).
- White campion** *S. latifolia*: Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt), 5.ix.1992 (D. Hutchings), 2.v.1993, 16.v.1993, 13.vi.1993 (F. Wright and R. Hawkins), 12.vi.1994.
- Red campion** *S. dioica*: Warren Farm, 5.ix.1992 (D. Hutchings), 2.v.1993.
- Knotgrass** *Polygonum aviculare*: Nonsuch Park, 25.vi.1993; Warren Farm, 1988–91 (J. Byatt), 5.ix.1992 (D. Hutchings).
- Redshank** *P. persicaria*: Nonsuch Park, 1988 (F. and J. Wright); Warren Farm, 1988 (F. and J. Wright), 5.ix.1992 (D. Hutchings).
- Russian vine** *P. aubertii*: Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt).
- Sheep's sorrel** *Rumex acetosella*: Warren Farm, 1988 (F. and J. Wright).
- Common sorrel** *R. acetosa*: Nonsuch Park, 12.vi.1994; Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt), 13.vi.1993 (F. Wright and R. Hawkins).
- Water dock** *R. hydrolapathum*: Nonsuch Park, 4.vii.1993 (R. Hawkins and F. Wright).
- Curled dock** *R. crispus*: Warren Farm 1988–91 (J. Byatt), 13.vi.1993 (F. Wright and R. Hawkins).
- Broad-leaved dock** *R. obtusifolius*: Warren Farm, 1988–91 (J. Byatt), 13.vi.1993 (F. Wright and R. Hawkins).
- Wood dock** *R. sanguineus*: Nonsuch Park, 25.vi.1993; Warren Farm, 1989–91 (J. Byatt).
- Perforate St John's wort** *Hypericum perforatum*: Warren Farm, 1988 (F. and J. Wright), 5.ix.92 (D. Hutchings), 13.vi.1993 (F. Wright and R. Hawkins).
- Lime** *Tilia* sp.: Nonsuch Park, 28.viii.1993.
- Small-leaved lime** *T. cordata*: Warren Farm/Surrey County Council strip, 13.vi.1993 (F. Wright and R. Hawkins).
- Lime** *Tilia vulgaris*: Warren Farm, 1988–91 (J. Byatt).
- Common mallow** *Malva sylvestris*: Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt), 5.ix.1992 (D. Hutchings), 13.vi.1993 (F. Wright and R. Hawkins).
- Sweet violet** *Viola odorata*: Warren Farm, 1988–91 (J. Byatt), by railway 1993 (F. Wright).
- Common dog-violet** *V. riviniana*: Cherry Orchard Farm, 24.iv.1993 (D. Hutchings); Warren Farm, 1988 (F. and J. Wright).
- Field pansy** *V. arvensis*: Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt), 5.ix.1992 (D. Hutchings).
- White bryony** *Bryonia dioica*: Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt), 5.ix.1992 (D. Hutchings), 13.vi.1993 (F. Wright and R. Hawkins).
- White poplar** *Populus alba*: Nonsuch Park, Round Pond, 7.x.1993.
- Willow** *Salix* sp.: Nonsuch Park, Round Pond, 16.v.1993, 7.x.1993; Cherry Orchard Farm, 12.vi.1994.
- Osier** *S. ?viminialis*: Warren Farm, 1988–91 (J. Byatt).
- Goat willow** *S. capraea*: Warren Farm, 1988–91 (J. Byatt).
- Grey willow** *S. cinerea atrocinerea*: Warren Farm, 1988–91 (J. Byatt).
- Hedge mustard** *Sisymbrium officinale*: 5.ix.1992 (D. Hutchings).
- Treacle mustard** *Erysimum cheiranthoides*: Nonsuch Park, 1988 (F. and J. Wright); Warren Farm, 1988 (F. and J. Wright).

- Garlic mustard/jack-by-the-hedge** *Alliaria petiolata*: Nonsuch Park, 25.vi.1993; Warren Farm, 1988–91 (J. Byatt), 2.v.1993.
- Thale cress** *Arabidopsis thaliana*: Nonsuch Park, cultivated ground — Mansion House, 24.iv.1993 (D. Hutchings).
- Horseradish** *Armoracia rusticana*: Warren Farm, 1988–91 (J. Byatt).
- Lady's smock/cuckoo flower** *Cardamine pratensis*: Nonsuch Park, 2.v.1993, 16.v.1993; Banqueting House, 1988, once prolific (F. and J. Wright), 1.v.1993.
- Hairy bittercress** *C. hirsuta*: Warren Farm, 1988–91 (J. Byatt).
- Tall or sand rock-cress** *Arabis arenosa*: Warren Farm, 12.vi.1994.
- Honesty** *Lunaria annua*: Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt).
- Shepherd's purse** *Capsella bursa*: Warren Farm, 1988 (F. and J. Wright).
- Hoary cress** *Lepidium draba*: Warren Farm, 1988–91 (J. Byatt).
- Perennial wall-rocket** *Diplotaxis tenuifolia*: Nonsuch Park, 5.ix.1992 (D. Hutchings); Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt), 1991 (R. Parker).
- Cabbage** *Brassica oleracea*: Warren Farm, 1988–91 (J. Byatt).
- Rape** *B. napus*: Warren Farm, 1988–91 (J. Byatt).
- Charlock** *Sinapis arvensis*: Nonsuch Park, 1988 (F. and J. Wright); Warren Farm, 1988 (F. and J. Wright).
- Wild radish** *Raphanus raphanistrum*: Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt).
- Scarlet pimpernel** *Anagallis arvensis*: Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt), 13.vi.1993 (F. Wright and R. Hawkins).
- Bramble** *Rubus fruticosus*: — no attempt has been made to identify to microspecies: Nonsuch Park, 25.vi.1993, 28.viii.1993; Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt), 28.viii.1993; Surrey County Council strip, 28.viii.1993.
- Dewberry** *R. caesius*: ? Warren Farm, 1992 (Surrey Flora Committee).
- Silverweed** *Potentilla anserina*: Warren Farm, 1988 (F. and J. Wright).
- Creeping cinquefoil** *P. reptans*: Nonsuch Park, 25.vi.1993, 28.viii.1993; Warren Farm, 1988–91 (J. Byatt), 13.vi.1993 (F. Wright and R. Hawkins); Nonsuch High School, 23.viii.1993.
- Wood avens/herb bennet** *Geum urbanum*: Nonsuch Park, 28.viii.1993; Cherry Orchard Farm, 12.vi.1994; Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt), 5.ix.1992 (D. Hutchings), 13.vi.1993 (F. Wright and R. Hawkins), 12.vi.1994; Nonsuch High School, 23.viii.1993.
- Agrimony** *Agrimonia eupatoria*: Nonsuch Park, 1988 (F. and J. Wright), 25.vi.1993; Surrey County Council strip, 1988 (F. and J. Wright); Warren Farm, 1988–91 (J. Byatt), 13.vi.1993 (F. Wright and R. Hawkins).
- Field rose** *Rosa arvensis*: Warren Farm, 1988–91 (J. Byatt).
- Dog rose** *Rosa canina*: Nonsuch Park, 25.vi.1993; Cherry Orchard Farm, 12.vi.1994; Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt).
- Blackthorn** *Prunus spinosa*: Nonsuch Park, 3.v.1993.
- Wild plum** *P. domestica*: Warren Farm, 1988–91 (J. Byatt).
- Cherry laurel** *P. laurocerasus*: Warren Farm, 1988–91 (J. Byatt).
- Wild cherry** *P. avium*: Cherry Orchard Farm, 24.iv.1993 (D. Hutchings); Warren Farm, 1988–91 (J. Byatt).
- Pear** *Pyrus* sp.: Warren Farm, 1988–91 (J. Byatt).
- Apple** *Malus domestica*: Warren Farm, 1988–91 (J. Byatt).
- Whitebeam** *Sorbus aria*: Warren Farm, 1988–91 (J. Byatt).
- Hawthorn** *Crataegus monogyna*: Nonsuch Park, 4.iv.1993; Cherry Orchard Farm, 12.vi.1994; Warren Farm, 1988–91 (J. Byatt), 7.x.1993.
- Kidney vetch** *Anthyllis vulneraria*: Warren Farm, 1991 (B. Dewhurst), 4.vii.1993 (F. Wright and R. Hawkins).
- Birdsfoot trefoil** *Lotus corniculatus*: Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt), 5.ix.1992 (D. Hutchings), 28.viii.1993.
- Greater birdsfoot trefoil** *L. pedunculatus*: Nonsuch Park, in ditch by newly-dug pond, 25.vi.1993.
- Tufted vetch** *Vicia cracca*: Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt), 5.ix.1992 (D. Hutchings).
- Hairy tare** *V. hirsuta*: Cherry Orchard Farm, 1991 (F. Wright); Warren Farm, 1988–91 (J. Byatt), 2.v.1993, 13.vi.1993 (F. Wright and R. Hawkins), 12.vi.1994.

- Common vetch** *V. sativa*: Nonsuch Park, 12.vi.1994; Cherry Orchard Farm, 12.vi.1994; Warren Farm, 1988–91 (J. Byatt), 5.ix.1992 (D. Hutchings), 13.vi.1993 (F. Wright and R. Hawkins), 12.vi.1994.
- Meadow vetchling** *Lathyrus pratensis*: Nonsuch Park, 1991 (B. Dewhurst), 25.vi.1993; Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt).
- Grass vetchling** *L. nissolia*: Nonsuch Park, 1991 (B. Dewhurst).
- Ribbed melilot** *Melilotus officinalis*: Warren Farm, 1988 (F. and J. Wright), 5.ix.1992 (D. Hutchings).
- Black medick** *Medicago lupulina*: Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt), 5.ix.1992 (D. Hutchings), 13.vi.1993 (F. Wright and R. Hawkins).
- Spotted medick** *M. arabica*: Cherry Orchard Farm, 12.vi.1994.
- White clover** *Trifolium repens*: Nonsuch Park, 25.vi.1993, 12.vi.1994 (including a 4-leaved clover); Cherry Orchard Farm, 12.vi.1994; Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt), 13.vi.1993 (F. Wright and R. Hawkins), 12.vi.1994; Nonsuch High School, 23.viii.1993.
- Hop trefoil** *T. campestre*: Warren Farm, 4.vii.1993 (F. Wright and R. Hawkins).
- Least trefoil** *T. dubium*: Cherry Orchard Farm, 12.vi.1994.
- Red clover** *T. pratense*: Nonsuch Park, 25.vi.1993, 12.vi.1994; Cherry Orchard Farm, 12.vi.1994; Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt), 5.ix.1992 (D. Hutchings), 13.vi.1993 (F. Wright and R. Hawkins), 12.vi.1994; Nonsuch High School, 23.viii.1993.
- Tree lupin** *Lupinus arboreus*: Warren Farm, 1991 (F. Wright), 3.vi.1993 (F. Wright and R. Hawkins).
- Broom** *Cytisus scoparius*: Warren Farm, 1988–91 (J. Byatt).
- Purple loosestrife** *Lythrum salicaria*: Nonsuch Park, 4.vii.1993 (R. Hawkins and F. Wright).
- Spurge laurel** *Daphne laureola*: Nonsuch Park, The Wood, 28.viii.1993.
- Great willowherb** *Epilobium hirsutum*: Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt).
- Hoary willowherb** *E. parviflorum*: Warren Farm, 1988–91 (J. Byatt).
- Broad-leaved willowherb** *E. montanum*: Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt), 5.ix.1992 (D. Hutchings).
- Square-stalked willowherb** *E. tetragonum*: Warren Farm, 1988–91 (J. Byatt).
- American willowherb** *E. ciliatum*: Warren Farm, 1988–91 (J. Byatt).
- Rosebay willowherb** *Chamerion angustifolium*: Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt).
- Evening primrose** *Oenothera biennis*: Warren Farm, 1991 (R. Parker).
- Holly** *Ilex aquifolia*: Nonsuch Park, 28.viii.1993.
- Sun spurge** *Euphorbia helioscopia*: Warren Farm, 1988–91 (J. Byatt).
- Dog's mercury** *Mercurialis perennis*: Cherry Orchard Farm, 2.v.1993.
- Buckthorn** *Rhamnus cathartica*: Warren Farm, 1988–91 (J. Byatt).
- Horse chestnut** *Aesculus hippocastanum*: Nonsuch Park, 2.v.1993; Cherry Orchard Farm, 2.v.1993; Warren Farm, 1988–91 (J. Byatt), 2.v.1993; Nonsuch High School, 23.viii.1993.
- Norway maple** *Acer platanoides*: Cherry Orchard Farm, 2.v.1993.
- Field maple** *A. campestre*: Nonsuch Park, 2.v.1993, 28.viii.1993; Cherry Orchard Farm, 2.v.1993; Surrey County Council strip, 16.v.1993; Warren Farm, 1988–91 (J. Byatt).
- Sycamore** *A. pseudoplatanus*: Nonsuch Park, 25.vi.1993, 28.viii.1993, 12.vi.1994; Cherry Orchard Farm, 2.v.1993, 16.v.1993; Surrey County Council, 28.viii.1993; Warren Farm, 1988–91 (J. Byatt), 2.v.1993; Nonsuch High School, 23.viii.1993.
- Wood sorrel** *Oxalis acetosella*: Nonsuch Park, 1988 (F. and J. Wright); Warren Farm, 1988 (F. and J. Wright).
- Large-flowered pink sorrel** *O. debilis* (= *O. corymbosa*): 51/235635, 1992 (Surrey Flora Committee).
- Cut-leaved cranesbill** *Geranium dissectum*: Cherry Orchard Farm, 12.vi.1994; Warren Farm, 1988 (F. and J. Wright), 13.vi.1993 (F. Wright and R. Hawkins), 12.vi.1994.
- Hedgerow cranesbill** *G. pyrenaicum*: Warren Farm, 1988 (F. and J. Wright), 5.ix.1992 (D. Hutchings).
- Dovesfoot cranesbill** *G. molle*: Nonsuch Park, 25.vi.1993, 12.vi.1994; Cherry Orchard Farm, 12.vi.1994; Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt).
- Herb Robert** *G. robertianum*: Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt), 5.ix.1993 (D. Hutchings).

- Ivy** *Hedera helix*: Nonsuch Park, 28.viii.1993; Warren Farm, 1988–91 (J. Byatt); Nonsuch High School, 23.viii.1993.
- Cow parsley** *Anthriscus sylvestris*: Nonsuch Park, 2.v.1993, 25.vi.1993; Cherry Orchard Farm, 1.v.1993, 12.vi.1994; Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt).
- Burnet saxifrage** *Pimpinella saxifraga*: Nonsuch Park, old wheat field, 23.viii.1993 (R. Hawkins and V. Wallace); Warren Farm, 5.ix.1993 (D. Hutchings).
- Ground elder** *Aegopodium podagraria*: Warren Farm, 1988–91 (J. Byatt); Nonsuch High School, 23.viii.1993.
- Angelica** *Angelica* sp.: Warren Farm, 1988 (F. and J. Wright).
- Pepper saxifrage** *Silau silaus*: Nonsuch Park, stunted in top mown field, 23.viii.1993 (R. Hawkins and V. Howard).
- Hogweed** *Heracleum sphondylium*: Nonsuch Park, 25.vi.1993; Cherry Orchard Farm, 7.x.1993, 12.vi.1994; Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt), 13.vi.1993 (F. Wright and R. Hawkins), 12.vi.1994.
- Hedge parsley** *Torilis japonica*: Warren Farm, 13.vi.1993 (F. Wright and R. Hawkins).
- Wild carrot** *Daucus carota*: Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt), 5.ix.1992 (D. Hutchings), 28.viii.1993; Nonsuch High School, 23.viii.1993.
- Bittersweet** *Solanum dulcamara*: Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt), 13.vi.1993 (F. Wright and R. Hawkins).
- Field bindweed** *Convolvulus arvensis*: Nonsuch Park, 25.vi.1993; Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt), 5.ix.1992 (D. Hutchings), 13.vi.1993 (F. Wright and R. Hawkins); Nonsuch High School, 23.viii.1993.
- Great bindweed** *C. silvatica*: Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt), 5.ix.1993 (D. Hutchings).
- Fringed water-lily** *Nymphoides peltata*: Nonsuch Park, newly-dug pond, 25.vi.1993, 1.viii.1993 (F. Wright and R. Hawkins).
- Green alkanet** *Pentaglottis sempervirens*: Cherry Orchard Farm, 1.v.1993.
- Water forget-me-not** *Myosotis scorpioides*: Nonsuch Park, by newly-dug pond, 25.vi.1993.
- Field forget-me-not** *M. arvensis*: Warren Farm, 13.vi.1993 (F. Wright and R. Hawkins).
- Bur forget-me-not** *Lappula squarrosa*: Cherry Orchard Farm, 1991 (F. Wright).
- Hedge woundwort** *Stachys sylvatica*: Nonsuch Park, 25.vi.1993; Cherry Orchard Farm, 12.vi.1994; Warren Farm, 1988–91 (J. Byatt), 5.ix.1992 (D. Hutchings).
- Black hoarhound** *Ballata nigra*: Nonsuch Park, 28.viii.1993; Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt), 5.ix.1992 (D. Hutchings), 13.vi.1993 (F. Wright and R. Hawkins).
- White deadnettle** *Lamium album*: Cherry Orchard Farm, 2.v.1993, 12.vi.1994; Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt), 5.ix.1992 (D. Hutchings).
- Red deadnettle** *L. purpureum*: Nonsuch Park, on cultivated ground, Mansion House, 24.iv.1993 (D. Hutchings); Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt).
- Henbit deadnettle** *L. amplexicaule*: Warren Farm, 1988–91 (J. Byatt).
- Hempnettle** *Galeopsis pubescens*: Nonsuch Park, 25.vi.1993.
- Ground ivy** *Glechoma hederacea*: Nonsuch Park, 25.vi.1993, 28.viii.1993; Cherry Orchard Farm, 24.iv.1993 (D. Hutchings), 2.v.1993; Banqueting House, 16.v.1993; Warren Farm, 1988–91 (J. Byatt), 2.v.1993, 13.vi.1993 (F. Wright and R. Hawkins); Nonsuch High School, 23.viii.1993.
- Selfheal** *Prunella vulgaris*: Nonsuch Park, 1988 stunted (F. and J. Wright); Warren Farm, 1988 (F. and J. Wright), 13.vi.1993 (F. Wright and R. Hawkins).
- Water mint** *Mentha aquatica*: Nonsuch Park, by newly-dug pond, 15.v.1993, 25.vi.1993; Nonsuch High School, 23.viii.1993.
- Spearmint** *M. spicata*: Warren Farm, 1988–91 (J. Byatt), 1991 (R. Parker).
- Mares tail** *Hippurus vulgaris*: Nonsuch Park, in newly-dug pond, 25.vi.1993.
- Starwort** *Callitriche* sp.: Nonsuch Park, in newly-dug pond, 15.v.1993, 25.vi.1993.
- Greater plantain** *Plantago major*: Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt), 13.vi.1993 (F. Wright and R. Hawkins).
- Ribwort plantain** *P. lanceolata*: Nonsuch Park, 12.vi.1994; Cherry Orchard Farm, 12.vi.1994; Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt), 13.vi.1993 (F. Wright and R. Hawkins); Nonsuch High School, 23.viii.1993.
- Butterfly bush** *Buddleja davidii*: Warren Farm, 1988–91 (J. Byatt).

- Ash** *Fraxinus excelsior*: Nonsuch Park, 25.vi.1993, 28.viii.1993; Surrey County Council strip, 2.v.1993; Warren Farm, 1988–91 (J. Byatt).
- Wild privet** *Ligustrum vulgare*: Nonsuch Park, 28.viii.1993.
- Great mullein** *Verbascum thapsus*: Warren Farm, 1991 (F. Wright).
- Ivy-leaved toadflax** *Cymbalaria muralis*: Nonsuch Park, 1988 (F. and J. Wright), wall of Mansion House gardens, 24.iv.1993 (D. Hutchings), 28.viii.1993.
- Common toadflax** *Linaria vulgaris*: Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt), 5.ix.1992 (D. Hutchings).
- Purple toadflax** *L. purpurea*: Warren Farm, 13.vi.1993 (F. Wright and R. Hawkins).
- Foxglove** *Digitalis purpurea*: Warren Farm, 1988–91 (J. Byatt).
- Germander speedwell** *Veronica chamaedrys*: Nonsuch Park, 1988 (F. and J. Wright); Cherry Orchard Farm, 24.iv.1993 (D. Hutchings); Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt), 5.ix.1992 (D. Hutchings), 13.vi.1993 (F. Wright and R. Hawkins), 12.vi.1994.
- Wall speedwell** *V. arvensis*: Warren Farm, 1988–91 (J. Byatt).
- Field speedwell** *V. persica*: Nonsuch Park, 1988 (F. and J. Wright), cultivated ground, 24.iv.1993 (D. Hutchings); Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt).
- Slender speedwell** *V. filiformis*: Warren Farm, 1988–91 (J. Byatt).
- Ivy-leaved speedwell** *V. hederifolia*: Cherry Orchard Farm, 24.iv.1993 (D. Hutchings); Surrey County Council strip, 2.v.1993; Warren Farm, 1988–91 (J. Byatt).
- Red bartsia** *Odontites verna*: Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt), 1991 (R. Parker).
- Knapweed broomrape** *Orobancha elatior*: Warren Farm, 1991 (B. Dewhurst).
- Common broomrape** *O. minor*: Warren Farm, 13.ix.1993 (M. Waite and F. Wright).
- Lady's bedstraw** *Galium verum*: Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt).
- Hedge bedstraw** *G. mollugo*: Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt), 5.ix.1992 (D. Hutchings), 2.v.1993.
- Goosegrass/cleavers** *G. aparine*: Nonsuch Park, 25.vi.1993; Warren Farm, 1988–91 (J. Byatt), 12.vi.1994.
- Elder** *Sambucus niger*: Nonsuch Park, 25.vi.1993, 28.viii.1993; Cherry Orchard Farm, 2.v.1993, 12.vi.1994; Surrey County Council strip, 2.v.1993; Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt), 2.v.1993, 12.vi.1994.
- Teasel** *Dipsacus purpurea*: Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt).
- Field scabious** *Knautia arvensis*: Nonsuch Park, on palace site field, 13.ix.1993 (F. Wright and M. Waite).
- Lesser burdock** *Arctium minus*: Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt), 13.vi.1993 (F. Wright and R. Hawkins).
- Burdock** *A. minus pubens*: Warren Farm, 1988–91 (J. Byatt).
- Wetted thistle** *Carduus crispus*: Warren Farm, 1988 (F. and J. Wright).
- Spear thistle** *Cirsium vulgare*: Warren Farm, 1988–91 (J. Byatt), 5.ix.1992 (D. Hutchings), 13.vi.1993 (F. Wright and R. Hawkins); Nonsuch High School, 23.viii.1993.
- Creeping thistle** *C. arvense*: Nonsuch Park, 25.vi.1993, 12.vi.1994; Cherry Orchard Farm, 28.viii.1993, 12.vi.1994; Warren Farm, 1988–91 (J. Byatt), 5.ix.1992 (D. Hutchings), 13.vi.1993 (F. Wright and R. Hawkins), 28.viii.1993, 12.vi.1994.
- Greater knapweed** *Centaurea scabiosa*: Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt), 5.ix.1992 (D. Hutchings).
- Perennial cornflower** *C. montana*: Cherry Orchard Farm, 1991 (F. Wright).
- Common/black knapweed** *C. nigra*: Nonsuch Park, 25.vi.1993, 12.vi.1994; Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt), 5.ix.1992 (D. Hutchings).
- Nippewort** *Lapsana communis*: Warren Farm, 1988 (F. and J. Wright).
- Common catsear** *Hypochoeris radicata*: Nonsuch Park, 25.vi.1993; Warren Farm, 5.ix.1992 (D. Hutchings), 13.vi.1993 (F. Wright and R. Hawkins), 12.vi.1994.
- Autumn hawkbit** *Leontodon autumnalis*: Warren Farm, 1988–91 (J. Byatt), 5.ix.1992 (D. Hutchings).
- Bristly oxtongue** *Picris echioides*: Warren Farm, 1988–91 (J. Byatt), 4.vii.1993 (F. Wright and R. Hawkins).
- Hawkweed oxtongue** *P. hieracioides*: Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt), 5.ix.1992 (D. Hutchings).

- Goatsbeard** *Tragopogon pratensis*: Nonsuch Park, 25.vi.1993, 12.vi.1994; Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt), 13.vi.1993 (F. Wright and R. Hawkins), 12.vi.1994; Nonsuch High School, 23.viii.1993.
- Perennial sow-thistle** *Sonchus arvensis*: Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt), 13.vi.1993 (F. Wright and R. Hawkins).
- Smooth sow-thistle** *S. oleraceus*: Warren Farm, 1988–91 (J. Byatt), 5.ix.1992 (D. Hutchings), 13.vi.1993.
- Prickly sow-thistle** *S. asper*: Warren Farm, 1988–91 (J. Byatt).
- Prickly lettuce** *Lactuca serriola*: Warren Farm, 1988–91 (J. Byatt), 1991 (R. Parker), 13.vi.1993, 13.ix.1993 (M. Waite, London Ecology Unit).
- Dandelion** *Taraxacum officinale* agg.: No attempt has been made to split this into its microspecies. Nonsuch Park, 12.vi.1994; Cherry Orchard Farm, 12.vi.1994; Warren Farm, 1988–91 (J. Byatt), 5.ix.1992 (D. Hutchings).
- Smooth hawksbeard** *Crepis capillaris*: Warren Farm, 1988–91 (J. Byatt), 13.vi.1993 (F. Wright and R. Hawkins), 12.vi.1994.
- Orange hawkweed** *Hieracium aurantiacum*: Warren Farm, 13.vi.1993 (F. Wright and R. Hawkins).
- Common fleabane** *Pulicaria dysenterica*: Warren Farm, 1988–91 (J. Byatt).
- Canadian golden rod** *Solidago canadensis*: Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt), 28.viii.1993.
- Michaelmas daisy** *Aster* sp: Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt).
- Blue fleabane** *Erigeron acer*: Warren Farm, 5.ix.1992 (D. Hutchings), 29.viii.1993 (P. Harvey and F. Wright).
- Canadian fleabane** *Conyza canadensis*: Warren Farm, 1988–91 (J. Byatt), 5.ix.1992 (D. Hutchings).
- Daisy** *Bellis perennis*: Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt), 5.ix.1992 (D. Hutchings).
- Mugwort** *Artemisia vulgaris*: Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt), 5.ix.1992 (D. Hutchings), 13.vi.1993 (F. Wright and R. Hawkins), 12.vi.1994.
- Yarrow** *Achillea millefolium*: Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt), 5.ix.1992 (D. Hutchings), 13.vi.1993 (F. Wright and R. Hawkins); Nonsuch High School, 23.viii.1993.
- Ox-eye daisy** *Leucanthemum vulgare*: Nonsuch Park, 25.vi.1993, 12.vi.1994; Warren Farm, 16.v.1993, 13.vi.1993 (F. Wright and R. Hawkins), 12.vi.1994.
- Scentless mayweed** *Matricaria inodorum*: Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt), 13.vi.1993 (F. Wright and R. Hawkins).
- Pineapple-weed** *M. discoidea*: Warren Farm, 1988 (F. and J. Wright), 5.ix.1992 (D. Hutchings), 13.vi.1993 (F. Wright and R. Hawkins).
- Ragwort** *Senecio jacobaea*: Warren Farm, 1988–91 (J. Byatt), 5.ix.1992 (D. Hutchings), 13.vi.1993 (F. Wright and R. Hawkins), 28.viii.1993.
- Hoary ragwort** *S. erucifolius*: Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt), 13.vi.1993 (F. Wright and R. Hawkins).
- Oxford ragwort** *S. squalidus*: Warren Farm, 1988 (F. and J. Wright).
- Groundsel** *S. vulgaris*: Warren Farm, 1988–91 (J. Byatt).
- Coltsfoot** *Tussilago farfara*: Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt), 2.v.1993.
- Winter heliotrope** *Petasites fragrans*: 1992 (Surrey Flora Committee); Warren Farm, 1988 (F. and J. Wright), 1988–91 (J. Byatt).
- Hemp agrimony** *Eupatorium cannabinum*: Nonsuch Park, 25.vi.1993.

MONOCOTYLEDONS

- Arrowhead** *Sagittaria sagittifolia*: Nonsuch Park, newly-dug pond, 25.vi.1993, 4.vii.1993 (F. Wright and R. Hawkins).
- Lords and ladies** *Arum maculatum*: Nonsuch Park, 28.viii.1993; Warren Farm, 1988 (F. and J. Wright).
- Fat duckweed** *Lemna gibba*: Nonsuch Park, 51/230640 ('Brown Pond' — my name, J.E.C.). 51/233638 (Round Pond), 1992, Surrey Flora Committee.
- Common duckweed** *L. minor*: Nonsuch Park, Round Pond, 16.v.1993.
- Hard rush** *Juncus inflexus*: Nonsuch Park, 25.vi.1993.
- Smooth rush** *J. effusus*: Nonsuch Park, newly-dug pond, 16.v.1993.
- Field wood rush** *Luzula campestris*: Nonsuch Park, 16.v.1993; Warren Farm, 1988–91 (J. Byatt).

- Hop sedge** *Carex pseudocyperus*: Nonsuch Park, 4.vii.1993 (R. Hawkins and F. Wright).
- Sedge** *Carex* sp.: Nonsuch Park, by newly-dug pond, 12.vi.1994.
- Meadow fescue** *Festuca pratensis*: Nonsuch Park, 12.vi.1994.
- Giant fescue** *F. gigantea*: Warren Farm, 1988–91 (J. Byatt), 12.vi.1994.
- Red fescue** *F. rubra*: Warren Farm, 1988–91 (J. Byatt), 13.vi.1993 (F. Wright and R. Hawkins).
- Perennial rye-grass** *Lolium perenne*: Nonsuch Park, 25.vi.1993, 12.vi.1994; Cherry Orchard Farm, 12.vi.1994; Warren Farm, 1988–91 (J. Byatt), 13.vi.1993 (F. Wright and R. Hawkins), 12.vi.1994.
- Squirreltail fescue** *Vulpia bromoides*: Warren Farm, 13.vi.1993 (R. Hawkins and F. Wright).
- Rough meadow-grass** *Poa trivialis*: Nonsuch Park, 25.vi.1993, 12.vi.1994; Cherry Orchard Farm, 12.vi.1994; Warren Farm, 13.vi.1993 (F. Wright and R. Hawkins).
- Smooth meadow-grass** *P. pratensis*: Warren Farm, 1988–91 (J. Byatt).
- Wood meadow-grass** *P. nemoralis*: Warren Farm, 1988–91 (J. Byatt).
- Cocksfoot** *Dactylis glomerata*: Nonsuch Park, 25.vi.1993, 12.vi.1994; Cherry Orchard Farm, 12.vi.1994; Warren Farm, 1988–91 (J. Byatt), 13.vi.1993 (F. Wright and R. Hawkins), 12.vi.1994; Nonsuch High School, 23.viii.1993.
- Wild oat** *Avena fatua*: Warren Farm, 1988–91 (J. Byatt).
- Yellow oat** *Arrhenatherum elatius*: Nonsuch Park, 25.vi.1993; Cherry Orchard Farm, 12.vi.1994; Warren Farm, 1988–91 (J. Byatt), 12.vi.1994.
- Yorkshire fog** *Holcus lanatus*: Nonsuch Park, 25.vi.1993, 12.vi.1994; Warren Farm, 1988–91 (J. Byatt), 13.vi.1993 (F. Wright and R. Hawkins), 12.vi.1994.
- Sweet vernal grass** *Anthoxanthum odoratum*: Warren Farm, 1988–91 (J. Byatt).
- Black bent** *Agrostis gigantea*: Warren Farm, 1988–91 (J. Byatt).
- Creeping bent** *A. stolonifera*: Warren Farm, 1988–91 (J. Byatt).
- Meadow foxtail** *Alopecurum pratensis*: Nonsuch Park, 25.vi.1993, 12.vi.1994.
- Timothy** *Phleum pratense*: Nonsuch Park, 25.vi.1993.
- Smaller catstail** *P. bertolonii*: Warren Farm, 1988–91 (J. Byatt).
- Soft brome** *Bromus hordeaceus*: Cherry Orchard Farm, 12.vi.1994; Warren Farm, 12.vi.1994.
- Hairy brome** *Bromopsis ramosa*: Warren Farm, 1988–91 (J. Byatt).
- Barren brome** *Anisantha sterilis*: Cherry Orchard Farm, 12.vi.1994.
- Wood brome** *Brachypodium sylvaticum*: Nonsuch Park, bird sanctuary copse, 16.v.1993, 25.vi.1993; Warren Farm, 1988–91 (J. Byatt); Nonsuch High School, 23.viii.1993.
- Common couch** *Elytrigia repens*: Warren Farm, 1988–91 (J. Byatt).
- Wall barley** *Hordeum murinum*: Nonsuch Park, 25.vi.1993; Warren Farm, 1988–91 (J. Byatt).
- Reedmace** *Typha* sp.: Nonsuch Park, newly-dug pond, 16.v.1993.
- Solomon's seal** *Polygonatum multiflorum*: Warren Farm, 24.iv.1993 (D. Hutchings).
- Bluebell** *Hyacinthoides non-scripta*: Cherry Orchard Farm, in woodland, 2.v.1993.
- Crow garlic** *Allium vineale*: Warren Farm, 1988 (F. and J. Wright).
- Yellow iris** *Iris pseudacorus*: Nonsuch Park, newly-dug pond, 25.vi.1993; 4.vii.1993 (F. Wright and R. Hawkins).
- Black bryony** *Tamus communis*: Nonsuch Park, 28.viii.1993; Warren Farm, 1988 (F. and J. Wright).

Molluscs — snails and slugs

Both in terms of numbers of species of land molluscs and abundance of individuals, Nonsuch Park was not as rich as Cherry Orchard Farm, Warren Farm or the Surrey County Council strip, even though these sites were smaller in area. Although the total list for most sites was around twenty species, the Nonsuch Park list was enhanced by its freshwater fauna, a habitat not present in the other areas, and its land mollusc list was eighteen species compared with twenty-six for Cherry Orchard Farm, twenty for the Surrey County Council strip and nineteen for Warren Farm. The fields on London Clay are often dry and the soil hard and impenetrable, while the woodland in Nonsuch Park is limited, with little depth of leaf litter and less dead wood (an important mollusc habitat) than Cherry Orchard Farm.

The richest area for molluscs was Cherry Orchard Farm and associated woodland, which also supported a dog's mercury sward and may have a longer woodland history

than the plantation strips in Nonsuch Park. In the woods by Cherry Orchard Farm a number of snails and slugs occurred on tree trunks and dead logs, especially *Lauria cylindracea*, *Ena obscura* and the tree slug *Limax marginatus*, with the cylindrical shell of the door snail *Clausilia bidentata* hanging on tree bark in the wooded strip of Surrey County Council land near the Banqueting House site. These species have not so far been found in Nonsuch Park.

The list shows a typical selection of species of neutral soil and lacks a strong woodland and wetland element. The more lime-rich soil of Warren Farm is indicated by the wrinkled snail *Candidula intersecta* and the Kentish snail *Monacha cantiana* which have a restricted distribution relating to soil chemistry and open country. The least common species found, but locally abundant at Nonsuch, was the glossy glass snail *Oxychilus helveticus* that was abundant on dead logs in woodland strips at Cherry Orchard Farm, Warren Farm and the Surrey County Council land. It demonstrates the importance of dead wood as a molluscan habitat. This snail was not seen in Nonsuch prior to 1962. The present survey confirms impressions from field work in Nonsuch by the author in the 1950s to 1962 that the park was the least productive area for land molluscs.

The freshwater fauna is limited by the tendency of the small ponds (many at the end of drainage ditches) to dry up for long periods. The small white-lipped ram's-horn snail *Anisus leucostoma*, which is a species typical of pools likely to dry up, was in several small ponds during 1960 but was not refound when the same sites were searched in May 1993. The large, newly-dug pond will provide a useful resource for aquatic molluscs in the future. It is probable that the existing freshwater snails came in with water plants brought in from elsewhere which have established, while mallards flying from the newly-dug pond may have transported the bladder snail *Physa heterostroph*a to the Round Pond where it was not recorded before.

Molluscs, unlike many insect groups, can be surveyed at any time of year, with the exception of extreme drought conditions, which make live specimens difficult to find. The present list of forty-three species can therefore be regarded as a representative one for the mollusc fauna of the Nonsuch sites and only a few additional species would be expected on future field work.

For the land molluscs the names follow *A field guide to the land snails of Britain and north-west Europe* (Kerney and Cameron 1979), but with inclusion of species not then recognized, and for the freshwater species, the latest checklist (Kerney 1976).

Field meetings 2 and 16 May, 29 August and 7 October 1993

Sites: NP Nonsuch Park, SCC Surrey County Council strip, COF Cherry Orchard Farm, BH Banqueting House site, WF Warren Farm.

A = alive; + = shell only; * = woodland

| | NP | SCC | Sites COF | BH | WF |
|--|----|-----|--------------|----|----|
| FRESHWATER SPECIES | | | | | |
| <i>Physa heterostroph</i> a — bladder snail | A | | | | |
| <i>Lymnaea stagnalis</i> — great pond snail | A | | | | |
| <i>L. peregra</i> — wandering pond snail | A | | | | |
| <i>Planorb</i> arius <i>corneus</i> — great ram's-horn snail | A | | | | |
| <i>Sphaer</i> ium <i>corneum</i> — horny orb mussel | A | | | | |
| <i>S. lacustre</i> — lake orb mussel | A | | | | |
| <i>Pisidium personatum</i> — pea mussel | A | | | | |
| TERRESTRIAL SPECIES | | | | | |
| <i>Carych</i> ium <i>tridentatum</i> — herald snail | | | A | | |
| <i>Cochlicopa lubrica</i> — slippery moss snail | A | A | A | A | A |
| <i>Lauria cylindracea</i> — chrysalis snail | | | A* | | |
| <i>Vallonia excentrica</i> — eccentric grass snail | | | | A | |
| <i>Acanthinula aculeata</i> — prickly snail | A | | | | |
| <i>Ena obscura</i> — lesser bulin | | A | A* | | |

| | NP | SCC | Sites COF | BH | WF |
|---|----|-----|--------------|----|----|
| <i>Punctum pygmaeum</i> — pygmy snail | | + | | | |
| <i>Discus rotundatus</i> — rounded snail | A | A | A* | A | A |
| <i>Arion ater</i> agg. — large slug | A | A | A | | A |
| <i>A. subfuscus</i> — dusky slug | A | A | A | | A |
| <i>A. circumscriptus</i> s.s. | | | A | | |
| <i>A. hortensis</i> | A | | A | | |
| <i>A. distinctus</i> | A | A | A | | |
| <i>A. intermedius</i> — hedgehog slug | A | A | A | A | A |
| <i>Vitrina pellucida</i> — pellucid glass snail | + | | | | + |
| <i>Nesovitrea hammonis</i> — rayed glass snail | | A | | | |
| <i>Aegopinella nitidula</i> — waxy glass snail | A | A | A | | A |
| <i>Oxychilus draparnaudi</i> — Draparnaud's glass snail | | | | | + |
| <i>O. alliarius</i> — garlic glass snail | A | A | | | A |
| <i>O. cellarius</i> — cellar glass snail | | A | A | | |
| <i>O. helveticus</i> — glossy glass snail | | A | A | A | A |
| <i>Milax sowerbyi</i> — Sowerby's or keeled slug | | | | | A |
| <i>M. budapestensis</i> — Budapest slug | A | | | | |
| <i>Limax maximus</i> — great grey slug | | A | A | | A |
| <i>L. marginatus</i> — tree slug | | A | A | | |
| <i>Deroceras reticulatum</i> — grey field slug | A | A | A | | A |
| <i>D. caruanae</i> | A | A | A | | A |
| <i>Cecilioides acicula</i> — blind snail | | | | + | |
| <i>Clausilia bidentata</i> — two-toothed door snail | | A | A | | |
| <i>Candidula intersecta</i> — wrinkled snail | | | | | A |
| <i>Monacha cantiana</i> — Kentish snail | | | A | | A |
| <i>Trichia striolata</i> — strawberry snail | A | A | A | | |
| <i>T. hispida</i> — hairy snail | A | | A | | A |
| <i>Cepaea nemoralis</i> — brown-lipped snail | A | | A | | + |
| <i>C. hortensis</i> — white-lipped snail | A | | A | | A |
| <i>Helix aspersa</i> — common garden snail | A | A | A | A | A |
| Species/site | 25 | 20 | 26 | 7 | 19 |
| Freshwater species | 7 | 0 | 0 | 0 | 0 |
| Land species | 18 | 20 | 26 | 7 | 19 |

Isopods — woodlice

These are all species commonly found in southern England. *Trichoniscus pusillus* is associated with dampness and is found in leaf litter, under logs in woods and around marshy areas of ponds, while *Philoscia muscorum* is highly tolerant and also found on open dry sites. *Armadillidium vulgare*, the pill woodlouse, and *Porcellio scaber* are indicative of more basic soil and their distribution more restricted. *Platyarthrus hoffmannseggii* is a small (4 mm), broad-bodied, milk-white woodlouse which lives underground and has no eyes. It is generally found in ants' nests and under capping of vegetation on walls — as on the retaining wall of the Banqueting House site. It is usually on calcareous ground, but being subterranean is much under recorded.

Further field work would extend the distribution ranges of some species while others, such as *Androniscus dentiger* (an attractive small 6 mm woodlouse which is pink with a central yellow stripe), should be looked for on the chalk soil of Warren Farm and the Surrey County Council land.

Details of woodlice are found in *Woodlice in Britain and Ireland: distribution and habitat* (Harding and Sutton 1985).

Field meetings 2 and 16 May, and 7 October 1993

Sites: NP Nonsuch Park, SCC Surrey County Council strip, COF Cherry Orchard Farm, BH Banqueting House site, WF Warren Farm.

Records by June Chatfield and Rosemary Hill.

| | NP | SCC | Sites COF | BH | WF |
|----------------------------------|----|-----|--------------|----|----|
| <i>Trichoniscus pusillus</i> | + | + | | | |
| <i>Oniscus asellus</i> | | | + | | + |
| <i>Philoscia muscorum</i> | + | | + | + | + |
| <i>Platyarthrus hoffmenseggi</i> | | | | + | |
| <i>Armadillidium vulgare</i> | + | | + | + | + |
| <i>Porcellio scaber</i> | + | | + | | |

Arachnids — spiders, harvestmen and pseudoscorpions

Araneae — true spiders

Spider records for Nonsuch in 1993 were contributed by Mrs Frances Murphy, Mr Peter Harvey and Miss Rosemary Hill. These animals are seasonal and different species are found on sequential visits. Juveniles cannot be identified, but require rearing in captivity or further field work later in the season to find them mature. The species will also differ with the precise part of the habitat, namely, canopy of trees and bushes, low herbage and ground level, and require different types of collecting method.

Frances Murphy collected on 2 May 1993 and found mostly common and widespread species, many of them typical of spring and early summer. They were in grasses, bushes and lower foliage, and collecting was entirely on Cherry Orchard Farm. The only unexpected species was *Mangora acalyphy*a, an orb-web spider which occurs in grasses and lower foliage in southern England. Mr John Murphy assisted with identification.

Peter Harvey collected on 16 May and 29 August 1993: this included Cherry Orchard Farm (grassland and woodland) and Warren Farm. He reported two notable species for Cherry Orchard Farm: *Zilla diodia* (scrub) and *Philodromus collinus* of the woodland edge. *Zilla diodia* is not numerous in southern England and *Philodromus collinus* is uncommon in south-east England. Both are species of early season.

Two other notable spiders, *Philodromus praedatus* and *P. longipalpis*, were taken along the old road on the Surrey County Council strip. *P. praedatus* is nationally notable and *P. longipalpis* represents only the seventh British specimen. The *Philodromus* were immature, but kept to maturity to check identification. *Sitticus pubescens* is a local species and *Enoplognatha latimana* has very few records in Surrey or anywhere in the country apart from Essex. Among the specimens recorded by Rosemary Hill in October 1993 were *Salticus scenicus*, *Araneus diadematus* and *A. quadratus*, which are species of late season. Further work on spiders at Nonsuch on a regular monthly basis and taking samples from all available habitat types would reveal a more complete picture.

The list of species follows *A check list of British spiders* by Merrett, Locket and Millidge (1985), published in the *Bulletin of the British Arachnological Society*.

FAMILY AMAUROBIIDAE — lace-webbed spiders
Amaurobius fenestralis: Cherry Orchard Farm woodland, 16.v.1993 (P. Harvey).

FAMILY DICTYNIDAE — mesh-webbed spiders
Dictyna arundinacea: Cherry Orchard Farm, grassland, 2.v.1993 (F. Murphy), 16.v.1993 P. Harvey).
D. uncinata: Cherry Orchard Farm, woodland, 16.v.1993 (P. Harvey).

FAMILY GNAPHOSIDAE — ground spiders
Micaria pilicaria: Warren Farm, 16.v.1993 (P. Harvey).

FAMILY CLUBIONIDAE — foliage spiders
Clubiona reclusa: Cherry Orchard Farm, 2.v.1993 (F. Murphy).
C. brevipes: Cherry Orchard Farm, woodland, 16.v.1993 (P. Harvey).

FAMILY ZORIDAE — ghost spiders

Zora spinimana: Warren Farm, 16.v.1993 (P. Harvey).

FAMILY ANYPHAENIDAE — buzzing spiders

Anyphaena accentuata: Cherry Orchard Farm, woodland, 16.v.1993 (P. Harvey).

FAMILY THOMISIDAE — crab spiders

Misumena vatia: Cherry Orchard Farm, grassland, 16.v.1993 (P. Harvey).

Xysticus cristatus: Nonsuch Park, grassland, 7.x.1993 (R. Hill); Cherry Orchard Farm, 2.v.1993 (F. Murphy), grassland, 7.x.1993 (R. Hill); Warren Farm, 7.x.1993 (R. Hill).

X. ulmi: Cherry Orchard Farm, grassland, 16.v.1993 (P. Harvey).

FAMILY PHILODROMIDAE — running crab spiders

Philodromus dispar: Cherry Orchard Farm, woodland, 16.v.1993 (P. Harvey).

P. aureolus: Cherry Orchard Farm, woodland, 16.v.1993 (P. Harvey).

P. cespitum: Cherry Orchard Farm, grassland, 16.v.1993 (P. Harvey).

P. praedatus: Warren Farm, 16.v.1993 (P. Harvey).

P. longipalpis: Warren Farm, 16.v.1993 (P. Harvey).

Tibellus oblongus: Warren Farm, 16.v.1993 (P. Harvey).

FAMILY SALTICIDAE — jumping spiders

Salticus scenicus: Banqueting House retaining wall, 7.x.1993 (R. Hill).

S. pubescens: Warren Farm, on dead wood, 29.viii.1993 (P. Harvey).

FAMILY LYCOSIDAE — wolf spiders

Pardosa amentata: Warren Farm, 16.v.1993 (P. Harvey).

FAMILY PISAURIDAE — Nursery web and raft spiders

Pisaura mirabilis: Cherry Orchard Farm, 2.v.1993 (F. Murphy), grassland and woodland, 7.x.1993 (R. Hill).

FAMILY THERIDIIDAE — comb-footed spiders

Achaeearanea lunata: Cherry Orchard Farm, woodland, 16.v.1993 (P. Harvey).

Theridion sisypium: Cherry Orchard Farm, grassland, 16.v.1993 (P. Harvey).

T. varians: Cherry Orchard Farm, woodland, 16.v.1993 (P. Harvey).

T. mystaceum: Cherry Orchard Farm, woodland, 16.v.1993 (P. Harvey).

T. tinctum: Cherry Orchard Farm, woodland, 16.v.1993 (P. Harvey).

T. binaculatum: Cherry Orchard Farm, grassland, 16.v.1993 (P. Harvey).

T. pallens: Cherry Orchard Farm, 2.v.1993 (F. Murphy), woodland, 16.v.1993 (P. Harvey); Warren Farm, 16.v.1993 (P. Harvey).

Enoplognatha ovata: Warren Farm, 29.viii.1993 (P. Harvey).

E. latimana: Warren Farm, 29.viii.1993 (P. Harvey).

FAMILY TETRAGNATHIDAE — long-jawed orb-weavers

Tetragnatha montana: Cherry Orchard Farm, 2.v.1993 (F. Murphy).

FAMILY METIDAE — orb weavers

Meta menegi: Cherry Orchard Farm, 2.v.1993 (F. Murphy), grassland, 16.v.1993 (P. Harvey).

FAMILY ARANEIDAE — orb weavers

Araneus diadematus: Nonsuch Park, The Wood, 7.x.1993 (R. Hill); Cherry Orchard Farm, woodland, 16.v.1993 (P. Harvey).

A. quadratus: Warren Farm, 29.viii.1993 (P. Harvey), 7.x.1993 (R. Hill).

Agalenatea redii: Cherry Orchard Farm, grassland, 16.v.1993 (P. Harvey); Warren Farm, 29.viii.1993 (P. Harvey).

Atea triguttatus: Warren Farm, 16.v.1993 (P. Harvey).

Araniella opisthographa: Cherry Orchard Farm, woodland, 16.v.1993 (P. Harvey); Warren Farm, 16.v.1993 (P. Harvey).

Zilla diodia: Cherry Orchard Farm, grassland, 16.v.1993 (P. Harvey).

Zygiella x-notata: Warren Farm, 28.viii.1993 (P. Harvey).

Mangora acalypha: Cherry Orchard Farm, 2.v.1993 (F. Murphy).

FAMILY LINYPHIIDAE — money spiders

Walckenaeria unicornis: Cherry Orchard Farm, grassland, 16.v.1993 (P. Harvey).

Bathypantes parvulus: Cherry Orchard Farm, 2.v.1993 (F. Murphy).

Stemonyphantes lineatus: Warren Farm, 2.v.1993 (F. Murphy).
Linyphia hortensis: Cherry Orchard Farm, 2.v.1993 (F. Murphy), woodland, 16.v.1993 (P. Harvey).

Opiliones — harvestmen

With the exception of *Dicranopalpus ramosus*, most of the species of harvestmen are of widespread distribution. The adults are usually around from July to the end of the year, although some are killed by the first frosts — the latter species overwintering as eggs. Some, like *Oligolophus tridens* and *Paroligolophus agrestis*, frequent a range of habitats from meadows and long grass to woods, and some are more frequent where there is rank grass, i.e. in the least-managed areas like Warren Farm. *Opilio saxatilis* prefers dry habitats and it was found at Warren Farm. *Leiobunum rotundum* often occurs in the upper foliage of trees and bushes and sometimes rests in the open on tree trunks and walls.

Dicranopalpus ramosus was first found in Britain in Bournemouth in 1957, and its distribution shown in Hillyard and Sankey (1989) is concentrated along the south of the country in synanthropic (human influenced) habitats. It can be beaten out of foliage, particularly holm oak.

Collecting by June Chatfield and Rosemary Hill on 7 October 1993 on a day of mixed weather — sunshine and showers — revealed eight species. Although old logs and leaf litter were examined in a search for *Nemastoma bimaculatum*, no specimens were found and this distinctive black short-legged species with two white spots should be looked for on future occasions. Another species curiously absent was *Mitopus morio*. Specimens were checked by John Sankey later the same day.

The list follows that in *Harvestmen* by Hillyard and Sankey (1989).

Sites: NP Nonsuch Park, COF Cherry Orchard Farm, BH Banqueting House site, WF Warren Farm.

| | Sites | | | |
|--------------------------------|-------|-----|----|----|
| | NP | COF | BH | WF |
| <i>Oligolophus tridens</i> | | + | | + |
| <i>Paroligolophus agrestis</i> | + | + | + | + |
| <i>Lacinius ephippiatus</i> * | | | | + |
| <i>Phalangium opilio</i> | + | | | |
| <i>Opilio saxatilis</i> * | | | | + |
| <i>Rilaena triangularis</i> * | + | | | |
| <i>Dicranopalpus ramosus</i> | + | | | |
| <i>Leiobunum rotundum</i> | + | | | + |
| Number of species | 5 | 2 | 1 | 5 |

*Checked by John Sankey

Pseudoscorpiones — false scorpions

Chthonius ischnocheles: Nonsuch Park, on dead wood in Long Ditch, 29.viii.1993 (J. Chatfield, det. G. Legg).

Insects

The majority of the insect records were made by Roger Hawkins during the survey days across the 1993 season. Lists made in 1993 and others from recent field work have been included, with the name of the recorder given in the text. The section of Nonsuch, habitat and date are also given. The names generally follow the latest volume for each group of Kloet and Hincks (1964–75), but for hoverflies the list follows Stubbs and Falk (1983). A general list of butterflies made from 1971–93 by the late Dr Desmond Seymour has been included together with some older literature records of Lepidoptera to stimulate further field work. Some existing Diptera records (1980s) made by Vic Howard have also been incorporated. Data on bugs collected by Eric Groves in 1954–5 are presented as Appendix 3. A separate report interpreting the field work on various

insect groups has been submitted by Roger Hawkins in which he comments on the significance of the finds, and this is presented verbatim in Appendix 4.

| | |
|---|-----|
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| Hymenoptera — bees, wasps and ants | 116 |
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Odonata — damselflies and dragonflies

FAMILY COENAGRIDA

Blue-tailed damselfly *Ischnura elegans*: Nonsuch Park, newly-dug pond, 13.vi.1993, 4.vii.1993, 1.viii.1993 (R. Hawkins).

Azure damselfly *Coenagrion puella*: Nonsuch Park, newly-dug pond, 13.vi.1993, 4.vii.1993, 1.viii.1993 (R. Hawkins), Round Pond, 16.v.1993 (R. Hill).

FAMILY LESTIDA

Emerald damselfly *Lestes sponsa*: Nonsuch Park, small pond, 1.ix.1991 (C. B. Ashby).

FAMILY AESHNIDA

Southern hawk *Aeshna cyanea*: Nonsuch Park, newly-dug pond, 4.vii.1993 (R. Hawkins).

Brown hawk *A. grandis*: Nonsuch Park, newly-dug pond, 23.vii.1989, 24.viii.1989, 1.ix.1991, 26.vii.1993 (all C. B. Ashby), 1.viii.1993 (R. Hawkins); Banqueting House, 4.vii.1993 (R. Hawkins).

Migrant hawk *A. mixta*: Nonsuch Park, newly-dug pond, 1.ix.1993 (C. B. Ashby).

Emperor dragonfly *Anax imperator*: Nonsuch Park, newly-dug pond, 27.vii.1989 (C. B. Ashby), 13.vi.1993, 4.vii.1993, 1.viii.1993 (R. Hawkins).

FAMILY LIBELLULIDA

Black-tailed skimmer *Orthetrum cancellatum*: Nonsuch Park, newly-dug pond, 24.viii.1989 (C. B. Ashby).

Broad-bodied chaser *Libellula depressa*: Nonsuch Park, a small pond, 30.v.1990 (C. B. Ashby), newly-dug pond, 13.vi.1993 (R. Hawkins).

Ruddy darter *Sympetrum sanguineum*: Nonsuch Park, small pond and newly-dug pond, 1.ix.1991 (C. B. Ashby), newly-dug pond, 1.viii.1993 (R. Hawkins).

Common darter *S. striolatum*: Nonsuch Park, small pond and newly-dug pond, 14.x.1984, 24.viii.1989, 1.ix.1991 (C. B. Ashby), newly-dug pond, 1.viii.1993, 23.viii.1993 (R. Hawkins).

Orthoptera — crickets and grasshoppers

FAMILY TETTIGONIDA

Oak bush-cricket *Meconema thalassium*: Nonsuch Park, by newly-dug pond, beaten from oak, 1.viii.1993 (R. Hawkins).

Roesel's bush-cricket *Metrioptera roeselii*: Cherry Orchard Farm, abundant in rough grass, 21.ix.1991, 26.viii.1993 (I. S. Menzies), 1.viii.1993 (R. Hawkins); Warren Farm, abundant in rough grass, 21.ix.1991, 26.viii.1993 (I. S. Menzies); Nonsuch High School, calls heard, 23.viii.1993 (R. Hawkins).

Dark bush-cricket *P. griseoaptera*: Cherry Orchard Farm, a few localized in field, 26.viii.1993 (I. S. Menzies), on western side of field, 29.viii.1993 (R. Hawkins), Banqueting House, 29.viii.1993 (R. Hawkins); Surrey County Council strip, western end, 29.viii.1993 (R. Hawkins).

Speckled bush-cricket *Leptophyes punctatissima*: Cherry Orchard Farm, larvae swept from nettles, 2.v.1993, larvae on brambles, 16.v.1993, 4.vii.1993 (R. Hawkins), larvae, 2.v.1993 (R. Hill); Banqueting House, larvae beaten, 4.vii.1993 (R. Hawkins); Warren Farm, 16.v.1993, larvae on brambles, hogweed, bindweed and nettles, 13.vi.1993, 4.vii.1993, beaten from apple tree, 1.viii.1993, beaten from Canadian golden rod, 29.viii.1993 (R. Hawkins); Nonsuch High School — 1 male found, 23.viii.1993 (R. Hawkins).

Long-winged conehead *Conocephalus discolor*: Warren Farm, single male in field, 26.viii.1993 (I. S. Menzies).

FAMILY ACRIDIDAE

Field grasshopper *Chorthippus brunneus*: Cherry Orchard Farm, 26.viii.1993 (I. S. Menzies); Warren Farm, 29.viii.1993 (R. Hawkins), 26.viii.1993 (I. S. Menzies); Nonsuch High School, 23.viii.1993 (R. Hawkins).

Meadow grasshopper *C. parallelus*: Nonsuch Park, in northern fields, 23.viii.1993, one in mown area, 29.viii.1993 (R. Hawkins); Cherry Orchard Farm, 4.vii.1993, 1.viii.1993 (R. Hawkins), 26.viii.1993 (I. S. Menzies); Warren Farm, 1.viii.1993, 29.viii.1993 (R. Hawkins).

Dermaptera — earwigs

Common earwig *Forficula auricularia*: Nonsuch Park, many beaten from trees, 29.viii.1993 (R. Hawkins), lime copse, 7.x.1993 (R. Hill), brick wall of Mansion House gardens, 29.viii.1993 (J. Chatfield); Cherry Orchard Farm, swept from nettles, 2.v.1993 (R. Hawkins), 7.x.1993 (R. Hill); Banqueting House, beaten from trees, 29.viii.1993 (R. Hawkins); Warren Farm, 7.x.1993 (J. Chatfield).

Hemiptera — true bugs

Suborder Heteroptera

FAMILY ACANTHOSOMATIDAE

Hawthorn shieldbug *Acanthosoma haemorrhoidale*: Nonsuch Park, 1.viii.1993, larva on Swedish whitebeam, 23.viii.1993, adults on hawthorn, pine and oak, larvae on hawthorn (R. Hawkins); Warren Farm, larva and adult beaten from hawthorn, 29.viii.1993 (R. Hawkins).

Juniper shieldbug *Cyphostethus tristriatus*: Nonsuch Park, two larvae from *Thuja*, 23.viii.1993, two adults and a larva beaten from Lawson's cypress, 29.viii.1993 (R. Hawkins).

Birch shieldbug *Elasmotethus interstinctus*: Nonsuch Park, adult on birch, 1.viii.1993, adult and larvae beaten from birch, 23.viii.1993, 29.viii.1993 (R. Hawkins).

Parent bug *Elasmucha grisea*: Nonsuch Park, adult beaten from birch, 23.viii.1993 (R. Hawkins); Cherry Orchard Farm, woodland, 7.x.1993 (R. Hill); Warren Farm, adult on tall grass, 13.vi.1993 (R. Hawkins).

FAMILY CYDNIDAE

Legnotus limbosus: Warren Farm, swept from cocksfoot grass, 29.viii.1993 (R. Hawkins).

Pied shieldbug *Sehirus bicolor*: Cherry Orchard Farm, swept from white deadnettle, 2.v.1993 (R. Hawkins).

FAMILY PENTATOMIDAE

Eysarcoris fabricii: Banqueting House, adult and larvae on hedge woundwort, 4.vii.1993 (R. Hawkins); Surrey County Council strip, adults and larvae beaten from hedge woundwort, 29.viii.1993 (R. Hawkins).

Green shieldbug *Palomena prasina*: Nonsuch Park, lime copse, 7.x.1993 (R. Hill); Surrey County Council strip, larva on oak, 29.viii.1993 (R. Hawkins); Warren Farm, adults and larvae on lime and oak, 29.viii.1993 (R. Hawkins); Nonsuch High School, adults and larvae on fruits of yellow iris, larvae on brambles and sycamore, 23.viii.1993 (R. Hawkins).

Gorse shieldbug *Piezodorus lituratus*: Nonsuch Park, larva swept from grassy field, 23.viii.1993 (R. Hawkins); Warren Farm, adults swept from red clover, 2.v.1993, 29.viii.1993 (R. Hawkins).

Brassica bug *Eurydema oleracea*: Nonsuch High School, two adults with empty larval skins in fruiting heads of wild carrot, 23.viii.1993 (R. Hawkins).

FAMILY COREIDAE

Coreus marginatus: Nonsuch Park, mating pairs on dock by newly-dug pond, 13.vi.1993, 4.vii.1993 (R. Hawkins); Cherry Orchard Farm, swept 16.v.1993 (R. Hawkins); Banqueting House, 7.x.1993 (R. Hill); Warren Farm, on brambles, 16.v.1993, adult on broad-leaved dock, 29.viii.1993 (R. Hawkins); Nonsuch High School, adult on dock, larva at base of grass tuft, 23.viii.1993 (R. Hawkins).

FAMILY RHOPALIDAE

Rhopalus subrufus: Cherry Orchard Farm, on short grass, 16.v.1993 (R. Hawkins); Nonsuch High School, adults 23.viii.1993 (R. Hawkins).

FAMILY LYGAEIDAE

Heterogaster urticae: Warren Farm, male on mugwort, 29.viii.1993 (R. Hawkins).

Chilacis typhae: Nonsuch Park, mating pair on reedmace heads by newly-dug pond, 1.viii.1993 (R. Hawkins).

- Ischnodemus sabuleti*: Cherry Orchard Farm, grass, 16.v.1993 (R. Hawkins).
Orsillus depressus: Nonsuch Park, adults and larvae on Lawson's cypress, 29.viii.1993 (R. Hawkins).
Kleidocerys resedae: Nonsuch Park, beaten from birch, 1.viii.1993 (R. Hawkins).
Stygnocoris rusticus: Warren Farm, on Canadian golden rod, 29.viii.1993 (R. Hawkins).
Drymus sylvaticus: Nonsuch Park, beaten from birch, 29.viii.1993 (R. Hawkins); Warren Farm, beaten from elm, 29.viii.1993 (R. Hawkins).
Scolopostethus thomsoni: Banqueting House, from sycamore, 16.v.1993 (R. Hawkins).
Gastrodes grossipes: Nonsuch Park, adults and larvae on larch, 23.viii.1993 (R. Hawkins).

FAMILY BERYTINIDAE

- Cymus melanocephalus*: Nonsuch Park, near newly-dug pond, 16.v.1993, 29.viii.1993 (on grass) (R. Hawkins).

FAMILY TINGIDAE

- Tingis ampliata*: Cherry Orchard Farm, from nettles and creeping thistle 16.v.1993, hogweed, 4.vii.1993 (R. Hawkins).

FAMILY NABIDAE

- Nabis rugosus*: Cherry Orchard Farm, on hogweed, 16.v.1993 (R. Hawkins); Warren Farm, from red clover, 13.vi.1993, Canadian golden rod, 29.viii.1993 (R. Hawkins).
Aptus mirmicoides: Warren Farm, on nettles, 29.viii.1993 (R. Hawkins).
Himacerus apterus: Nonsuch Park, on larch, 1.viii.1993 (R. Hawkins).
Nabicula limbata: Cherry Orchard Farm, on mugwort, 1.viii.1993 (R. Hawkins); Warren Farm, on Canadian golden rod, 29.viii.1993 (R. Hawkins).

FAMILY ANTHOCORIDAE

- Anthocoris nemoralis*: Nonsuch Park, on birch, 1.viii.1993; Warren Farm, on hawthorn, 2.v.1993, 13.vi.1993 (R. Hawkins).
A. nemorum: Nonsuch Park, on oak and willow, 1.viii.1993, on oak, 29.viii.1993 (R. Hawkins), by Round Pond, 7.x.1993 (R. Hill); Cherry Orchard Farm, on bindweed and nettles, 1.viii.1993 (R. Hawkins); Banqueting House, 4.vii.1993 (R. Hawkins); Surrey County Council strip, on sycamore, 2.v.1993; Warren Farm, on hawthorn and bindweed, 13.vi.1993, on oak, 1.viii.1993 (R. Hawkins).
Tetraphleps bicuspidis: Nonsuch Park, on larch, 29.viii.1993 (R. Hawkins).

FAMILY MIRIDAE

- Deraeocoris lutescens*: Nonsuch Park, on oak, 13.vi.1993, 1.viii.1993, 29.viii.1993 (R. Hawkins); Cherry Orchard Farm, on oak, willow and sycamore, 29.viii.1993 (R. Hawkins); Banqueting House, on sycamore, 1.viii.1993 (R. Hawkins); Surrey County Council strip, on oak, 29.viii.1993 (R. Hawkins); Warren Farm, on willow, 29.viii.1993 (R. Hawkins).
D. olivaceus: Nonsuch Park, on hawthorn by newly-dug pond, 13.vi.1993 (R. Hawkins).
D. ruber: Cherry Orchard Farm, adults and larvae on nettles, 4.vii.1993 (R. Hawkins).
Alloeotomus gothicus: Nonsuch Park, from pine, 1.viii.1993 (R. Hawkins).
Amblytylus nasutus: Cherry Orchard Farm, on grass and thistles, 4.vii.1993 (R. Hawkins); Warren Farm, on grass, 13.vi.1993, grass and yarrow clump, 4.vii.1993 (R. Hawkins).
Harpocera thoracica: Nonsuch Park, on oak, 16.v.1993 (R. Hill); Banqueting House, on oak, 16.v.1993 (R. Hawkins); Surrey County Council strip, on oak, 2.v.1993; Warren Farm, on oak, 2.v.1993 (R. Hawkins).
Phylus melanocephalus: Warren Farm, from oak, 13.vi.1993 (R. Hawkins).
Psallus ambiguus: Warren Farm, on apple tree, 13.vi.1993 (R. Hawkins).
P. diminutus: Warren Farm, on oak, 13.vi.1993 (R. Hawkins).
P. falleni: Nonsuch Park, from birch, 1.viii.1993 (R. Hawkins).
P. varians: Warren Farm, on oak, 13.vi.1993 (R. Hawkins).
P. wagneri: Warren Farm, on hawthorn, 13.vi.1993 (R. Hawkins).
Phoenicocoris obscurellus: Nonsuch Park, on pine, 1.viii.1993 (R. Hawkins).
Atractotomus mali: Warren Farm, on hawthorn, 13.vi.1993 (R. Hawkins).
Plagiognathus albipennis: Warren Farm, from mugwort, 29.viii.1993 (R. Hawkins).
P. arbustorum: Cherry Orchard Farm, on nettles, 4.vii.1993, on mugwort and nettles, 1.viii.1993 (R. Hawkins); Banqueting House, on nettles, 4.vii.1993, 1.viii.1993 (R. Hawkins); Warren Farm, 4.vii.1993 (R. Hawkins).
P. chrysanthemi: Nonsuch Park, on knotgrass, 23.viii.1993 (R. Hawkins); Warren Farm, from grass, ragwort and yarrow, 4.vii.1993, 1.viii.1993, on red clover, 29.viii.1993 (R. Hawkins).

- Dicyphus epilobii*: Nonsuch Park, on greater willowherb, by newly-dug pond, 4.vii.1993, 1.viii.1993 (R. Hawkins).
- Campyloneura virgula*: Nonsuch Park, beaten from oak and ivy, 4.vii.1993 (R. Hawkins); Banqueting House, beaten from elm, 4.vii.1993 (R. Hawkins).
- Pilophorus perplexus*: Surrey County Council strip, beaten from oak, 29.viii.1993 (R. Hawkins).
- Orthocephalus coriaceus*: Warren Farm, grass and yarrow, 4.vii.1993 (R. Hawkins).
- O. saltator*: Nonsuch Park, northern fields, 23.viii.1993 (R. Hawkins).
- Malacocoris chlorizans*: Nonsuch Park, on sallow, 1.viii.1993; Cherry Orchard Farm, under trees, 1.viii.1993 (R. Hawkins).
- Cyllocoris histrionicus*: Banqueting House, larva on oak, 16.v.1993 (R. Hawkins).
- Dryophilocoris flavoquadriaculatus*: Nonsuch Park, on oak, 16.v.1993 (R. Hill); Banqueting House, on oak, 16.v.1993 (R. Hawkins).
- Heterotoma planicornis*: Nonsuch Park, on sallow, 1.viii.1993 (R. Hawkins); Cherry Orchard Farm, on nettles, 4.vii.1993 (R. Hawkins); Banqueting House, on nettles, 4.vii.1993 (R. Hawkins).
- Blepharidopterus angulatus*: Nonsuch Park, on birch, 1.viii.1993, 29.viii.1993 (R. Hawkins); Warren Farm, on nettles below elms, 29.viii.1993 (R. Hawkins).
- Orthotylus viridinervis*: Warren Farm, teneral adult from oak, 13.vi.1993 (R. Hawkins).
- O. marginalis*: Nonsuch Park, on hawthorn, 13.vi.1993, on sallow, 1.viii.1993 (R. Hawkins); Warren Farm, on apple, 13.vi.1993 (R. Hawkins).
- O. prasinus*: Banqueting House, from rowan below hawthorn and elm, 4.vii.1993 (R. Hawkins).
- O. flavosparsus*: Nonsuch Park, beaten from goosefoot and orache, 23.viii.1993 (R. Hawkins).
- Liocoris tripustulatus*: Nonsuch Park, on nettles, 4.vii.1993, 1.viii.1993 (R. Hawkins); Cherry Orchard Farm, from nettles, 16.v.1993, 1.vii.1993 (R. Hawkins); Banqueting House, on nettles, 1.viii.1993 (R. Hawkins); Warren Farm, on nettles, 13.vi.1993 (R. Hawkins).
- Orthops cervinus*: Cherry Orchard Farm, from ivy, 29.viii.1993 (R. Hawkins); Banqueting House, from ash, 16.v.1993 (R. Hawkins).
- O. caupestris*: Cherry Orchard Farm, on hogweed, 2.v.1993 (R. Hawkins).
- Lygocoris pabulinus*: Nonsuch Park, beaten from goosefoot and orache, 23.viii.1993 (R. Hawkins); Warren Farm, larva on nettles, 13.vi.1993 (R. Hawkins).
- L. lucorum*: Cherry Orchard Farm, on mugwort, 1.viii.1993, 29.viii.1993 (R. Hawkins); Warren Farm, from grass and yarrow, 4.vii.1993, from mugwort, 29.viii.1993 (R. Hawkins).
- Calocoris quadripunctatus*: Nonsuch Park, adults and larvae from oak, 16.v.1993 (R. Hawkins), 16.v.1993 (R. Hill); Banqueting House, from oak, 16.v.1993 (R. Hawkins).
- C. norvegicus*: Cherry Orchard Farm, 4.vii.1993 (R. Hawkins); Warren Farm, adults and larvae on nettles, catsear and ox-eye daisy, 13.vi.1993, 4.vii.1993 (R. Hawkins).
- C. sexguttatus*: Nonsuch Park, 16.v.1993 (R. Hill).
- Adelphocoris lineolatus*: Warren Farm, from clover, 1.viii.1993, from grass, plantain and ragwort, 29.viii.1993 (R. Hawkins).
- Megacoelum infusum*: Surrey County Council, from oak, 29.viii.1993 (R. Hawkins); Warren Farm, from oak, 29.viii.1993 (R. Hawkins).
- Stenotus binotatus*: Nonsuch Park, on willowherb and nettles, 4.vii.1993 (R. Hawkins); Cherry Orchard Farm, on grass, 4.vii.1993 (R. Hawkins); Warren Farm, larvae, 13.vi.1993, adults, 4.vii.1993 (R. Hawkins).
- Phytocoris dimidiatus*: Nonsuch Park, on horse chestnut trunk, 13.vi.1993 (R. Hawkins).
- P. tiliae*: Nonsuch Park, from oak, 29.viii.1993 (R. Hawkins); Warren Farm, from elm and oak, 29.viii.1993 (R. Hawkins).
- P. varipes*: Warren Farm, swept, 1.viii.1993, 29.viii.1993 (R. Hawkins).
- Capsus ater*: Nonsuch Park, on grass, 13.vi.1993 (R. Hawkins).
- Stenodema calcaratum*: Cherry Orchard Farm, swept, 2.v.1993 (R. Hawkins); Warren Farm, on low herbage, 4.vii.1993 (R. Hawkins).
- S. laevigatum*: Nonsuch Park, on grass, 1.viii.1993, 29.viii.1993 (R. Hawkins); Cherry Orchard Farm, on grass, 2.v.1993 (R. Hawkins); Banqueting House, on grass, 16.v.1993, beaten from sycamore at dusk, 29.viii.1993 (R. Hawkins); Warren Farm, on grass, 29.viii.1993 (R. Hawkins); Nonsuch High School, on grass, 23.viii.1993 (R. Hawkins).
- Notostira elongata*: Warren Farm, adult and larva, 13.vi.1993 (R. Hawkins); Nonsuch High School, from grass, 23.viii.1993 (R. Hawkins).
- Megaloceraea recticornis*: Cherry Orchard Farm, on grass or thistle, 4.vii.1993 (R. Hawkins).
- Leptopterna dolabrata*: Cherry Orchard Farm, on grass, 4.vii.1993 (R. Hawkins); Warren Farm, from apple and grass, 13.vi.1993 (R. Hawkins).

Suborder Homoptera

FAMILY CERCOPIDAE

Cercopis vulnerata: Cherry Orchard Farm, field, 16.v.1993 (R. Hawkins and R. Hill).

- Aphrophora alni*: Surrey County Council strip/Cherry Orchard Farm, beaten from Norway maple, 29.viii.1993; Warren Farm, beaten from oak, 13.vi.1993 (R. Hawkins).
Philaenus spumarius: Warren Farm, 29.viii.1993 (R. Hawkins).
Neophilaenus lineatus: Nonsuch Park, northern field, 23.viii.1993; Warren Farm, 29.viii.1993 (R. Hawkins).

FAMILY MEMBRACIDAE

- Centronotus cornutus*: Banqueting House, on brambles beneath oak, 16.v.1993 (R. Hawkins and R. Hill).

FAMILY CICADELLIDAE

- Ledra aurita*: Banqueting House, nymph on trunk of oak, 16.v.1993 (R. Hawkins).
Iassus lanio: Surrey County Council strip, beaten from oak, 4.vii.1993 (R. Hawkins).

FAMILY ISSIDAE

- Issus coleoptratus*: Nonsuch Park, Mansion House, beaten from ivy covering wall, 4.vii.1993 (R. Hawkins).

Neuroptera — lacewings

- Chrysoperla carnea*: Nonsuch Park, by newly-dug pond, 16.v.1993 (R. Boyce); Cherry Orchard Farm, 2.v.1993 (R. Hawkins, det. G. A. Collins).
Hemerobius humulinus: Nonsuch Park, by newly-dug pond, 1.viii.1993 (R. Hawkins, det. G. A. Collins).
H. micans: Nonsuch Park, by Round Pond and by newly-dug pond, 16.v.1993 (R. Boyce).
Wesmaelius betulinus: Cherry Orchard Farm, 2.v.1993 (R. Hawkins, det. G. A. Collins).

Mecoptera — scorpionflies

- Panorpa germanica*: Warren Farm, 16.v.1993 (R. Hawkins, det. G. A. Collins).

Lepidoptera — butterflies and moths

Most of this list derives from cumulative records made by the late Dr Desmond Seymour from 1971 to present to which are added the records from the survey days and British Naturalists' Association meetings.

BUTTERFLIES

- Small skipper** *Thymelicus sylvestris*: D. Seymour's list; Banqueting House, 4.vii.1993 (R. Hawkins).
Essex skipper *T. lineola*: A large colony in Warren Farm, extending to Cherry Orchard Farm (D. Seymour); Nonsuch Park, by newly-dug pond, 1.viii.1993 (R. Hawkins); Cherry Orchard Farm, 4.vii.1993 (R. Hawkins), Warren Farm, 1.viii.1993 (R. Hawkins).
Large skipper *Ochlodes venata*: D. Seymour's list; Cherry Orchard Farm, 4.vii.1993 (R. Hawkins); Warren Farm, 13.vi.1993 (R. Hawkins).
Clouded yellow *Colias croceus*: Seen in some years only (D. Seymour).
Brimstone *Gonepteryx rhamni*: D. Seymour's list.
Large white *Pieris brassicae*: D. Seymour's list; Warren Farm, 5.ix.1992 (D. Hutchings).
Small white *P. rapae*: D. Seymour's list.
Green-veined white *P. napi*: D. Seymour's list; Nonsuch Park, newly-dug pond, 1.viii.1993 (R. Hawkins); Banqueting House, 16.v.1993 (R. Hill).
Orange-tip *Anthocharis cardamines*: D. Seymour's list; Warren Farm, 24.iv.1993 (D. Hutchings).
Green hairstreak *Callophrys rubi*: Old published record — on chalk at Nonsuch (Evans and Evans 1973).
Purple hairstreak *Quercusia quercus*: In woodland, along the London Road and in the central plantation (D. Seymour). Published record — on chalk at Nonsuch, 1964 (Evans and Evans 1973); Nonsuch Park, around oak trees by London Road, 1.viii.1993 (R. Hawkins).
White-letter hairstreak *Strymonidia w-album*: Published records — Nonsuch Park 1964–6 R. J. Cooter, 1969–70 P. J. Churchill (Evans and Evans 1973).
Small copper *Lycaena phlaeas*: D. Seymour's list; Nonsuch Park, newly-dug pond, 1.viii.1993 (R. Hawkins).

Common blue *Polyommatus icarus*: D. Seymour's list; Nonsuch Park, 25.vi.1993 (J. Chatfield); Warren Farm, 13.vi.1993, 29.viii.1993 (R. Hawkins); Nonsuch High School, 23.viii.1993 (J. Chatfield).

Holly blue *Celastrina argiolus*: D. Seymour's list.

Chalkhill blue *Lysandra coridon*: Literature record (Evans and Evans 1973).

Red admiral *Vanessa atalanta*: D. Seymour's list; Nonsuch Park, Mansion House gardens, 7.x.1993 (R. Hill).

Painted lady *Cynthia cardui*: D. Seymour's list.

Small tortoiseshell *Aglais urticae*: D. Seymour's list; Cherry Orchard Farm, larvae on nettles, 16.v.1993, 4.vii.1993 (R. Hawkins); Banqueting House, 4.vii.1993 (R. Hawkins); Warren Farm, 5.ix.1992, 24.iv.1993 (D. Hutchings), larvae on nettles, 13.vi.1993, 29.viii.1993 (R. Hawkins).

Peacock *Inachis io*: D. Seymour's list; Nonsuch Park, by newly-dug pond, 1.viii.1993 (R. Hawkins); Cherry Orchard Farm, 1.viii.1993 (R. Hawkins); Warren Farm, larvae on nettles, 13.vi.1993 (R. Hawkins).

Camberwell beauty *Nymphalis antiopa*: D. Seymour, single specimen, 1974.

Comma *Polygonia c-album*: D. Seymour's list; Published record for Nonsuch Park 1962–7 M. G. Matthews (Evans and Evans 1973); Nonsuch Park, newly-dug pond, 25.vi.1993 (J. Chatfield), 1.viii.1993 (R. Hawkins), Mansion House gardens, 7.x.1993 (R. Hill); Surrey County Council strip, 1.viii.1993 (R. Hawkins); Warren Farm, 7.x.1993 (R. Hill).

Speckled wood *Pararge aegeria*: D. Seymour's list; Nonsuch Park, by newly-dug pond, 25.vi.1993 (J. Chatfield), 13.vi.1993, 1.viii.1993 (R. Hawkins); Surrey County Council strip, 29.viii.1993 (J. Chatfield); Warren Farm, 29.viii.1993 (J. Chatfield).

Gatekeeper *Pyronia tithonus*: D. Seymour's list; published record for Nonsuch Park, P. J. Churchill (Evans and Evans 1973).

Meadow brown *Maniola jurtina*: D. Seymour's list; Nonsuch Park, 16.v.1993 (R. Hill), 29.viii.1993 (J. Chatfield); Cherry Orchard Farm, 4.vii.1993 (R. Hawkins); Banqueting House, 4.vii.1993 (R. Hawkins); Warren Farm, 5.ix.1992 (D. Hutchings), 13.vi.1993 (R. Hawkins).

Small heath *Coenonympha pamphilus*: D. Seymour's list.

Ringlet *Aphantopus hyperantus*: A small colony in the south-west corner (D. Seymour); Cherry Orchard Farm, 4.vii.1993 (R. Hawkins).

MOTHS

Adela reaumurilla: Surrey County Council strip, 16.v.1993 (R. Hill).

Six-spot burnet *Zygaena filipendulae*: Nonsuch Park, near newly-dug pond, 1.viii.1993 (R. Hawkins).

Plumeless plume *Emmelina monodactyla*: Nonsuch Park, lime copse, 7.x.1993 (R. Hill).

Tortrix viridana: Warren Farm, beaten from oak, 13.vi.1993 (R. Hawkins).

Yellow shell *Camptogramma bilineata*: Warren Farm, 13.vi.1993 (R. Hawkins).

Cinnabar *Tyria jacobaeae*: Warren Farm, 13.vi.1993 (R. Hawkins).

Small yellow underwing *Panemeria tenebrata*: Warren Farm, on bedstraw, 2.v.1993 (R. Hawkins).

Burnet companion *Euclidia glyphica*: Warren Farm, 13.vi.1993 (R. Hawkins).

Diptera — two-winged flies

FAMILY TIPULIDAE

Tipula lunata: Banqueting House, 16.v.1993 (R. Hill).

FAMILY BIBIONIDAE

Bibio marci: Nonsuch Park, by Round Pond, 16.v.1993 (R. Hill); Cherry Orchard Farm, woodland, 16.v.1993 (R. Hill and R. Hawkins).

B. nigriventris: Cherry Orchard Farm, 2.v.1993 (R. Hawkins).

Diplophus femoratus: Nonsuch Park, meadow and trees by Round Pond and newly-dug pond, 16.v.1993 (R. Boyce); Cherry Orchard Farm, woodland, 16.v.1993 (R. Hill).

FAMILY MYCETOPHILIDAE

Macrocera stigmoides: Surrey County Council strip, 16.v.1993 (R. Boyce).

FAMILY SCIARIDAE

Schwenkfeldina carbonaria: Nonsuch Park, by Round Pond, 16.v.1993 (R. Royce); Cherry Orchard Farm, 16.v.1993 (R. Boyce); Warren Farm, 16.v.1993 (R. Boyce).

FAMILY STRATIOMYIIDAE — soldier-flies

Sargus bipunctatus (V. Howard).

Odontomyia tigrina: Nonsuch Park, newly-dug pond, 16.v.1993 (R. Boyce), 13.vi.1993 (R. Hawkins).

Beris chalybaeta: Warren Farm, 16.v.1993 (R. Hawkins).

Pachygaster atra: Cherry Orchard Farm, many beaten from currant bushes, 4.vii.1993 (R. Hawkins).

Chloromyia formosa: Warren Farm, 13.vi.1993; Cherry Orchard Farm, 4.vii.1993 (R. Hawkins).

Odontomyia tigrina: Nonsuch Park, by newly-dug pond, 13.vi.1993 (R. Hawkins).

FAMILY TABANIDAE — horse-flies

Haematopota pluvialis: Nonsuch Park, 51/23-63-, 25.vii.1984 (V. Howard), by newly-dug pond, 1.viii.1993 (R. Hawkins); Cherry Orchard Farm, 4.vii.1993 (R. Hawkins).

FAMILY ASILIDAE — robber-flies

Machimus atricepillus: Warren Farm, 29.viii.1993 (P. Harvey).

Neoitamus cyanurus: Warren Farm, 13.vi.1993 (R. Hawkins).

Dioctria atricapilla: Warren Farm, 13.vi.1993 (R. Hawkins).

D. rufipes: Nonsuch Park, 51/23-63-, 12.vi.1989 (V. Howard).

FAMILY EMPIDIDAE

Platypalpus agilis: Nonsuch Park, trees by Round Pond, 16.v.1993 (R. Hawkins); Warren Farm, 16.v.1993 (R. Boyce).

Bicellaria vana: Nonsuch Park, edge of newly-dug pond, 16.v.1993 (R. Boyce); Banqueting Hall, 16.v.1993 (R. Boyce).

Rhamphomyia (*Pararhamphomyia*) *atra*: Warren Farm, 16.v.1993 (R. Boyce).

R. (P.) tarsata: Nonsuch Park, trees by Round Pond and newly-dug pond, 16.v.1993 (R. Boyce); Cherry Orchard Farm, 16.v.1993 (R. Boyce).

R. (Aclonempis) albohirta: Banqueting House, 16.v.1993 (R. Boyce).

Empis (Xanthempis) aemula: Nonsuch Park, newly-dug pond, 16.v.1993 (R. Boyce).

E. (X.) stercoratus: Nonsuch Park, 51/22-62-, 29.v.1987 (V. Howard).

E. (X.) trigramma: Nonsuch Park, trees by Round Pond, 16.v.1993 (R. Boyce); Cherry Orchard Farm, 2.v.1993 (R. Hawkins).

E. (Pachymeria) femorata: Nonsuch Park, by Round Pond, 16.v.1993 (R. Boyce).

E. (P.) tessellata: Nonsuch Park, by Round Pond, 16.v.1993 (R. Hill); Cherry Orchard Farm, 16.v.1993 (R. Hawkins); Warren Farm, 16.v.1993 (R. Hill).

Empis aestiva: Warren Farm, 16.v.1993 (R. Boyce).

E. caudatula: Nonsuch Park, by Round Pond and edge of newly-dug pond, 16.v.1993 (R. Boyce).

E. nigripes: Nonsuch Park, newly-dug pond, 16.v.1993 (R. Boyce); Surrey County Council strip, 16.v.1993 (R. Boyce).

E. nuntia: Nonsuch Park, edge of newly-dug pond, 16.v.1993 (R. Boyce).

Hilara clypeata: Nonsuch Park, by Round Pond, 16.v.1993 (R. Boyce).

FAMILY LONCHOPTERIDAE

Lonchoptera lutea: Cherry Orchard Farm, 16.v.1993 (R. Boyce).

FAMILY SYRPHIDAE — hover-flies

Melanostoma scalare: Nonsuch Park, trees by Round Pond, 16.v.1993 (R. Boyce); Cherry Orchard Farm, woodland, 16.v.1993 (R. Boyce); Warren Farm, on hogweed flowers, 13.vi.1993 (R. Hawkins).

Platycheirus albimanus: Nonsuch Park, 51/23-63-, 28.vi.1984 (V. Howard); Cherry Orchard Farm, woodland, 16.v.1993 (R. Boyce); Warren Farm, 16.v.1993 (R. Boyce), 13.vi.1993 (R. Hawkins).

P. angustatus: Cherry Orchard Farm, 2.v.1993 (R. Hawkins); Warren Farm, swept, 29.viii.1993 (R. Hawkins).

P. clypeatus: Cherry Orchard Farm, 16.v.1993 (R. Hawkins).

P. scutatus: Cherry Orchard Farm woodland, 2.v.1993, 16.v.1993 (R. Boyce and R. Hawkins).

Xanthandrus comtus: Nonsuch Park, 51/228631, 11.ix.1985 (V. Howard).

Chrysotoxum cautum: Nonsuch Park, 51/22-62-, 29.v.1987 (V. Howard).

C. festivum: Nonsuch Park, by newly-dug pond, 4.vii.1993 (R. Hawkins).

- Dasysyrphus venustus*: Banqueting House, 16.v.1993 (R. Hawkins).
- Epistrophe diaphana*: (V. Howard).
- E. eligans*: Nonsuch Park, by Round Pond, 16.v.1993 (R. Hill), 51/228631, 9.v.1984 (V. Howard); Cherry Orchard Farm, 16.v.1993 (R. Hawkins).
- E. grossulariae*: Nonsuch Park, by newly-dug pond, 13.vi.1993 (R. Hawkins), 51/228631, 3.viii.1984 (V. Howard).
- Episyrphus balteatus*: Nonsuch Park, by Round Pond, 16.v.1993 (R. Hill), 13.vi.1993 (R. Hawkins), Mansion House, 7.x.1993 (R. Hill), The Wood, 7.x.1993 (R. Hill), 51/228631, 25.viii.1985 (V. Howard); Cherry Orchard Farm, 16.v.1993 (R. Hawkins), 29.viii.1993 (R. Robbins), 7.x.1993 (R. Hill); Warren Farm, 16.v.1993 (R. Hill), 13.vi.1993 (R. Hawkins).
- Leucozona lucorum*: Cherry Orchard Farm, 16.v.1993 (R. Hawkins).
- Melangyna cincta*: Cherry Orchard Farm, 2.v.1993 (R. Hawkins).
- M. labiatarum*: Nonsuch Park, 51/229641, 18.vi.1993 (V. Howard).
- Metasyrphus luniger*: Cherry Orchard Farm, 29.viii.1993 (R. Robbins); Warren Farm, 13.vi.1993 (R. Hawkins).
- Parasyrphus punctulatus*: Cherry Orchard Farm, 2.v.1993 (R. Hawkins).
- Scaeva pyrastris*: Nonsuch Park, 51/22-62-, 29.v.1987 (V. Howard).
- Sphaerophoria scripta*: Nonsuch Park, by Round Pond, 16.v.1993 (R. Boyce); Cherry Orchard Farm, 2.v.1993 (R. Hawkins), 29.viii.1993 (R. Robbins).
- Syrphus ribesii*: Nonsuch Park, edge of newly-dug pond, 16.v.1993 (R. Boyce), 51/228631, 13.viii.1985 (V. Howard); Cherry Orchard Farm, 2.v.1993 (R. Hawkins), 29.viii.1993 (R. Robbins).
- S. torvus*: Nonsuch Park, 51/228631, 25.viii.1985 (V. Howard).
- S. vitripennis*: Cherry Orchard Farm, 29.viii.1993 (R. Robbins); Warren Farm, 29.viii.1993 (R. Hawkins).
- Xanthogramma citrofasciatum*: Cherry Orchard Farm, 16.v.1993 (P. Harvey).
- X. pedisequum*: Warren Farm, 29.viii.1993 (R. Hawkins).
- Cheilosia bergenstammi*: Banqueting House, 16.v.1993 (R. Hawkins).
- C. illustrata*: Nonsuch Park, 51/228631, 19.vii.1984, 1.vii.1986 (V. Howard).
- C. impressa*: Cherry Orchard Farm, 29.viii.1993 (R. Robbins); Warren Farm, 29.viii.1993 (R. Hawkins and P. Harvey).
- C. pagana*: Banqueting House, 16.v.1993 (R. Hawkins).
- C. soror*: Warren Farm, 29.viii.1993 (P. Harvey).
- Eristalinus sepulchralis*: Banqueting House, 16.v.1993 (R. Hawkins).
- Eristalis arbustorum*: Nonsuch Park, 51/22-62-, 11.ix.1985 (V. Howard); Cherry Orchard Farm, 29.viii.1993 (R. Robbins); Warren Farm, on hogweed flowers, 13.vi.1993, 29.viii.1993 (R. Hawkins).
- E. intricarius*: Nonsuch Park, 51/22-62-, 28.vii.1984 (V. Howard).
- E. nemorum*: Cherry Orchard Farm, 29.viii.1993 (R. Robbins).
- E. pertinax*: Nonsuch Park, newly-dug pond, 1.viii.1993 (R. Hawkins), 51/23-63-, 10.ix.1984 (V. Howard); Cherry Orchard Farm, 29.viii.1993 (R. Robbins).
- E. tenax*: Nonsuch Park, Mansion House, 7.x.1993 (R. Hill); Cherry Orchard Farm, 29.viii.1993 (R. Robbins).
- Helophilus pendulus*: Banqueting House, 16.v.1993 (R. Hawkins).
- Myathropa florea*: Nonsuch Park, Round Pond, 16.v.1993 (R. Hill), 51/229641, 27.vi.1984 (V. Howard); Cherry Orchard Farm, 29.viii.1993 (R. Robbins); Banqueting House, on hogweed flowers, 4.vii.1993 (R. Hawkins); Surrey County Council strip, 16.v.1993 (R. Hawkins).
- Parhelophilus versicolor*: Nonsuch Park, edge of newly-dug pond, aquatic larvae in leaf sheaths of *Typha*, 16.v.1993 (R. Boyce).
- Merodon equestris*: Nonsuch Park, 51/22-62-, 2.vii.1987 (V. Howard).
- Eumerus tuberculatus*: Nonsuch Park, grass in northern fields, 23.viii.1993 (R. Hawkins).
- Pipizella varipes*: Warren Farm, 16.v.1993 (R. Boyce), 16.v.1993, from wild carrot, 29.viii.1993 (R. Hawkins).
- P. virens*: Nonsuch Park, 51/22-62-, 12.vii.1985 (V. Howard).
- Volucella bombylans*: Nonsuch Park, 51/22-62-, 12.vii.1985, 14.vii.1985, 2.viii.1987 (V. Howard); Warren Farm, 13.vi.1993 (R. Hawkins).
- V. inanis*: Nonsuch Park, by newly-dug pond, 4.vii.1993 (R. Hawkins); Warren Farm, 13.vi.1993 (R. Hawkins).
- V. pellucens*: Nonsuch Park, 13.vi.1993, by newly-dug pond on flowers of creeping thistle, 1.viii.1993 (R. Hawkins).
- V. zonaria*: Nonsuch Park, 51/23-63-, 18.vi.1984 (V. Howard).
- Xylota xanthocnema*: Nonsuch Park, 51/23-63-, 27.vi.1984 (V. Howard).
- Syritta pipiens*: Nonsuch Park, 13.vi.1993 (R. Hawkins); Cherry Orchard Farm, 29.viii.1993 (R. Robbins); Warren Farm, 29.viii.1993 (R. Hawkins).

FAMILY CONOPIDAE

Conops quadrifasciatus: Warren Farm, 29.viii.1993 (P. Harvey).

Physocephala rufipes: Nonsuch Park, by newly-dug pond, 4.vii.1993 (R. Hawkins); Warren Farm, 29.viii.1993 (P. Harvey).

FAMILY TEPHRITIDAE — gall-makers

Tephritis vespertina: Warren Farm, swept from burdock, 13.vi.1993 (R. Hawkins).

T. vespertina: Cherry Orchard Farm, 2.v.1993 (R. Hawkins).

FAMILY PSILIDAE

Psila fimetaria: Cherry Orchard Farm, woodland, 16.v.1993 (R. Boyce).

FAMILY SCIOMYZIDAE

Coremacera marginata: Warren Farm, 7.x.1993 (R. Hill).

Tetanocera elata: Nonsuch Park, by newly-dug pond, 16.v.1993 (R. Boyce).

FAMILY CHLOROPIDAE

Elachiptera cornuta: Warren Farm, 16.v.1993 (R. Boyce).

FAMILY SCATHOPHAGIDAE

Scathophaga squalida: Warren Farm, 16.v.1993 (R. Boyce).

FAMILY TACHINIDAE

Trixia oestroidea: Cherry Orchard Farm, wood, 16.v.1993 (R. Boyce).

T. ruralis: Warren Farm, 16.v.1993 (R. Boyce).

Lydella stabulans: Nonsuch Park, trees by Round Pond, 16.v.1993 (R. Boyce).

FAMILY CALLIPHORIDAE

Sarcophaga carnaria: Nonsuch Park, by lime copse, 7.x.1993 (R. Hill); Warren Farm, 16.v.1993 (R. Hill).

FAMILY MUSCIDAE

Hydrotaea similis: Nonsuch Park, edge of newly-dug pond, 16.v.1993 (R. Boyce).

Phaonia palpata: Cherry Orchard Farm, woodland, 16.v.1993 (R. Boyce).

P. rufipalpis: Nonsuch Park, by Round Pond, 16.v.1993 (R. Boyce).

Helina flagripes: Nonsuch Park, trees by Round Pond, 16.v.1993 (R. Boyce); Warren Farm, 16.v.1993 (R. Boyce).

H. rothi: Nonsuch Park, trees by Round Pond, 16.v.1993 (R. Boyce).

Hymenoptera — bees, wasps and ants

Peter Harvey, who joined the survey meetings on 16 May and 28 August 1993, noted that the Hymenoptera were exceptionally good in the variety of species present and in the occurrence of seven nationally notable species (Falk 1991b). These were:

Notable A — *Lasius brunneus* (ant), *Hylaeus cornutus* (bee), *Andrena tibialis* (bee).

Notable B — *Pemphredon morio* (wasp), *Lestiphorus bicinctus* (wasp), *Lasioglossum malachurum* (bee), *Melitta tricincta* (bee).

The flower-rich nature of Warren Farm is of great importance to the Hymenoptera as a source of pollen and nectar. Some species have obligate associations with particular plants, e.g. *Melitta tricincta* and the red bartsia which occurs particularly along the sides of the paths. Also species such as *Hylaeus cornutus* are probably dependent on good stands of plants such as thistles, ragwort and wild carrot. It is very important that Warren Farm area is not cut throughout the spring and summer months, or at least alternating areas be cut in spring and late summer.

On the other hand it is also important that in the long term, scrub invasion does not occur to any great extent. The well-worn paths are very useful as we noted during the day — many Hymenoptera need open bare ground for nesting and these conditions are produced by well-used paths.

The two standing dead trunks near the remains of the old farm buildings are of particular importance. Many of the Hymenoptera (and other invertebrates such as

certain beetles) require dead wood for nesting. Some of the nationally notable species were taken here. These trunks and any further ones in future should be retained.

The bee *Andrena tibialis* is apparently associated with pollen of *Salix* and possibly hawthorn. It nests in light, usually sandy, soil in sunny locations such as sparsely vegetated banks, slopes and footpaths, usually in small aggregations or solitary.

Suborder Symphyta — sawflies

FAMILY TENTHREDINIDAE

Selandria serva: Nonsuch Park, by newly-dug pond, 13.vi.1993 (R. Hawkins).

Dolerus nigratus: Cherry Orchard Farm, 16.v.1993 (R. Hawkins).

Aglaostigma fulvipes: Warren Farm, 2.v.1993 (R. Hawkins).

Tenthredopsis litterata: Warren Farm, 13.vi.1993 (R. Hawkins).

Tenthredo atra: Warren Farm, 2.v.1993, 16.v.1993 (R. Hawkins).

T. notha (= *T. perkinsi*): Warren Farm, 1.viii.1993.

Pachyprotasis rapae: Cherry Orchard Farm, 2.v.1993; Surrey County Council strip, 29.viii.1993 (R. Hawkins).

Macrophya punctum-album: Cherry Orchard Farm, 16.v.1993 (R. Hawkins).

Hoplocampa crataegi: Nonsuch Park, 16.v.1993 (R. Hawkins).

Mesoneura opaca: Cherry Orchard Farm, 2.v.1993 (R. Hawkins).

Superfamily Formicoidea — ants

Myrmica rubra: Cherry Orchard Farm, 16.v.1993 (P. Harvey).

M. scabrinodis: Warren Farm, 29.viii.1993 (P. Harvey).

Formica cunicularia: Warren Farm, 29.viii.1993 (P. Harvey).

Lasius brunneus: Banqueting House, on oak trunk, 16.v.1994 (P. Harvey).

L. flavus, yellow meadow-ant: Banqueting House, on top of brick wall, 16.v.1993 (J. Chatfield); Surrey County Council strip, 28.viii.1993 (J. Chatfield).

L. niger, black lawn-ant: Cherry Orchard Farm, 16.v.1993 (P. Harvey); Warren Farm, 29.viii.1993 (P. Harvey).

Superfamily Sphecoidea — wasps

Paravespula germanica: Warren Farm, 29.viii.1993 (P. Harvey).

P. vulgaris: Warren Farm, 29.viii.1993 (P. Harvey).

Trypoxylon clavicercum: Warren Farm, 29.viii.1993 (P. Harvey).

T. medium: Warren Farm, 29.viii.1993 (P. Harvey).

Crossocerus annulipes: Warren Farm, 29.viii.1993 (P. Harvey).

C. quadrimaculatus: Warren Farm, 29.viii.1993 (P. Harvey).

Ectemnius cavifrons: Warren Farm, 29.viii.1993 (P. Harvey).

E. continuus: Warren Farm, 29.viii.1993 (P. Harvey).

Lindenius panzeri: Warren Farm, 29.viii.1993 (P. Harvey).

Entomognathus brevis: Warren Farm, 29.viii.1993 (P. Harvey).

Pemphredon lugubris: Warren Farm, 29.viii.1993 (P. Harvey).

P. morio: Warren Farm, 29.viii.1993 (P. Harvey).

Mellinus arvensis: Warren Farm, 29.viii.1993 (P. Harvey).

Lestiphorus bicinctus: Warren Farm, 29.viii.1993 (P. Harvey).

Tiphia femorata: Warren Farm, 29.viii.1993 (P. Harvey).

Superfamily Apoidea — bees

Hylaeus annularis: Warren Farm, 29.viii.1993 (P. Harvey).

H. brevicornis: Warren Farm, 29.viii.1993 (P. Harvey).

H. communis: Warren Farm, 29.viii.1993 (P. Harvey).

H. cornutus: Warren Farm, 29.viii.1993 (P. Harvey).

Andrena haemorrhoa: Cherry Orchard Farm, 16.v.1993 (P. Harvey); Warren Farm, northern edge, 16.v.1993 (P. Harvey).

A. minutula: Warren Farm, 29.viii.1993 (P. Harvey).

A. pubescens: Cherry Orchard Farm, 16.v.1993 (P. Harvey).

A. scotica: Cherry Orchard Farm, 16.v.1993 (P. Harvey).

A. tibialis: Warren Farm, northern edge, 16.v.1993 (P. Harvey).

Lasioglossum calceatum: Warren Farm, 29.viii.1993 (P. Harvey).

L. laevigatum: Warren Farm, 29.viii.1993 (P. Harvey).

L. leucopum: Warren Farm, 29.viii.1993 (P. Harvey).

L. malachurum: Warren Farm, 29.viii.1993 (P. Harvey).

- Sphecodes monilicornis*: Warren Farm, 29.viii.1993 (P. Harvey).
Melitta tricincta: Warren Farm, 29.viii.1993 (P. Harvey).
Chelostoma campanulum: Warren Farm, 29.viii.1993 (P. Harvey).
Osmia caerulea: Warren Farm, 29.viii.1993 (P. Harvey).
Megachile willughbiella: Warren Farm, 29.viii.1993 (P. Harvey).
Nomada flavoguttata: Warren Farm, 16.v.1993 (P. Harvey).
N. marshamella: Warren Farm, 16.v.1993 (P. Harvey).
N. ruficornis: Warren Farm, 16.v.1993 (P. Harvey).
Apis mellifera: Nonsuch Park, found by Round Pond, 16.v.1993 (R. Hill).

Coleoptera — beetles

FAMILY SCAPHIDIIDAE

- Scaphidium quadrimaculatum*: Cherry Orchard Farm, under dead log, 2.v.1993 (J. Chatfield, det. R. Hawkins).

FAMILY LUCANIDAE — stag beetles

- Dorcus parallelipidus* **lesser stag beetle**: Surrey County Council strip, 16.v.1993 (R. Hill); Warren Farm, on dead trees, 29.viii.1993 (P. Harvey and Frances Wright).

FAMILY SCARABAEIDAE

- Phyllopertha horticola* **garden chafer**: Surrey County Council strip, 12.vi.1993 (J. Chatfield and F. Wright); 13.vi.1993 Warren Farm, visiting hogweed, (R. Hawkins).

FAMILY ELATERIDAE — click beetles

- Cidnopus minutus*: Cherry Orchard Farm, many swept, 2.v.1993 (R. Hawkins).
Athous haemorrhoidalis Cherry Orchard Farm, several found, 2.v.1993 (R. Hawkins); Warren Farm, beaten from oak, 13.vi.1993 (R. Hawkins).
A. hirtus: Cherry Orchard Farm, beaten from elder, 4.vii.1993.
Agriotes acuminatus: Surrey County Council strip, two beaten, 2.v.1993 (R. Hawkins).
A. obscurus: Cherry Orchard Farm, swept from grass, 16.v.1993 (R. Hawkins).

FAMILY CANTHARIDAE — soldier beetles

- Cantharis decipiens*: Cherry Orchard Farm, 16.v.1993 (R. Hill); Banqueting House, beaten, 16.v.1993 (R. Hawkins); Surrey County Council strip, beaten, 2.v.1993 (R. Hawkins); Warren Farm, beaten, 16.v.1993 (R. Hawkins).
C. livida: Cherry Orchard Farm, on hogweed flowers, 4.vii.1993 (R. Hawkins); Warren Farm, 13.vi.1993 (R. Hawkins).
C. pellucida: Cherry Orchard Farm, swept from hogweed, 16.v.1993 (R. Hawkins).
C. rufa: Warren Farm, 13.vi.1993 (R. Hawkins).
C. rustica: Warren Farm, on goosegrass, 16.v.1993 (R. Hawkins), 16.v.1993 (R. Hill).
Rhagonycha fulva: Nonsuch Park, on hogweed flowers, 1.viii.1993 (R. Hawkins); Cherry Orchard Farm, many on hogweed flowers, 4.vii.1993, on hogweed, 1.viii.1993 (R. Hawkins); Banqueting House, many on hogweed flowers, 4.vii.1993, on hogweed flowers, 1.viii.1993 (R. Hawkins).
R. lignosa: Warren Farm, several beaten from sycamore, 16.v.1993 (R. Hawkins).
R. limbata: Cherry Orchard Farm, two swept from grass, 16.v.1993 (R. Hawkins).
Malthinus balteatus: Nonsuch Park, newly-dug pond, two beaten from oak, 4.vii.1993 (R. Hawkins).
M. seriepunctatus: Nonsuch Park, two beaten from oak, 4.vii.1993 (R. Hawkins).

FAMILY ANOBIIDAE

- Anobium punctatum*: Nonsuch Park, two beaten from oak by newly-dug pond (R. Hawkins).

FAMILY MELYRIDAE

- Malachius bipustulatus*: Warren Farm, a few swept from grass and composites, 13.vi.1993 (R. Hawkins).

FAMILY COCCINELLIDAE — ladybirds

- Subcoccinella 24-punctata* **24-spot ladybird**: Cherry Orchard Farm, on grass, 2.v.1993, 1.viii.1993 (R. Hawkins), woodland, 7.x.1993 (R. Hill); Banqueting House, 7.x.1993 (R. Hill); Warren Farm, larvae on false oat-grass, 13.vi.1993, beaten from thistles and golden rod, 29.viii.1993 (R. Hawkins); Nonsuch High School, swept from grass, 23.viii.1993 (R. Hawkins).
Coccidula rufa: Nonsuch Park, near pond, 16.v.1993 (R. Hawkins).

- Rhyzobus litura*: Cherry Orchard Farm, on grass, 2.v.1993, swept from grass and nettles, 16.v.1993 (R. Hawkins); Warren Farm, swept from grass and nettles, 16.v.1993, 13.vi.1993, beaten from St John's wort, 29.viii.1993 (R. Hawkins).
- Scymnus suturalis*: Nonsuch Park, beaten from pine and larch, 1.viii.1993, from pine, Mansion House, 23.viii.1993, from pine, 29.viii.1993 (R. Hawkins).
- Exochomus 4-pustulatus* **pine ladybird**: Nonsuch Park, on trunks of avenue of horse chestnuts from Ewell gate, and near egg-sacs of the scale insect *Pulvinaria regalis*, 2.v.1993, on same trunks, including pairs, 16.v.1993, adults and many larvae on trunks, 13.vi.1993, large larvae and pupae on trunks, 4.vii.1993, pupae on trunks, 1.viii.1993, beaten from trees, 29.viii.1993 (R. Hawkins); Cherry Orchard Farm, beaten from trees, 29.viii.1993 (R. Hawkins); Banqueting House, beaten from trees, 29.viii.1993 (R. Hawkins); Surrey County Council strip, beaten from trees, 29.viii.1993 (R. Hawkins); Warren Farm, beaten from trees, 29.viii.1993 (R. Hawkins).
- Adonia variegata* **Adonis's ladybird**: Nonsuch Park, on fat-hen and orache, 23.viii.1993 (R. Hawkins).
- Anisostrieta 19-punctata* **water ladybird**: Nonsuch Park, by newly-dug pond, 1.viii.1993 (R. Hawkins).
- Aphidecta oblitterata* **larch ladybird**: Nonsuch Park, beaten from larch, 2.v.1993 (R. Hawkins).
- Tytthaspis 16-punctata* **16-spot ladybird**: Nonsuch Park, many swept from grass, 23.viii.1993 (R. Hawkins); Warren Farm, 1.viii.1993; Nonsuch High School, swept from grass, 23.viii.1993 (R. Hawkins).
- Adalia bipunctata* **two-spot ladybird**: Nonsuch Park, on birch, 1.viii.1993, beaten from oak and maple, 29.viii.1993 (R. Hawkins), by Round Pond, 16.v.1993 (R. Hill); Cherry Orchard Farm, on nettles, including pair, 16.v.1993, on hogweed, 4.vii.1993 (R. Hawkins); Warren Farm, on various plants, 13.vi.1993, beaten from oak and maple, 29.viii.1993 (R. Hawkins).
- A. 10-punctata* **ten-spot ladybird**: Nonsuch Park, on and below oak, 23.viii.1993 (R. Hawkins); Surrey County Council strip, beaten from trees, 29.viii.1993 (R. Hawkins); Nonsuch School, on sycamore, 23.viii.1993 (R. Hawkins).
- Coccinella 7-punctata* **seven-spot ladybird**: Nonsuch Park, on nettles, 1.viii.1993, 23.viii.1993, on lime, oak and low plants, 29.viii.1993 (R. Hawkins), 7.x.1993 (R. Hill); Cherry Orchard Farm, on nettles, 16.v.1993, fresh adults on hogweed, 4.vii.1993, on lime, oak and low plants, 29.viii.1993 (R. Hawkins); Banqueting House, fresh adults on hogweed, 4.vii.1993 (R. Hawkins); Surrey County Council strip, on lime, oak and low plants, 29.viii.1993 (R. Hawkins); Warren Farm, on nettles, 2.v.1993, adults and larvae, 13.vi.1993, on nettles, 1.viii.1993, on lime oak and low plants, 29.viii.1993 (R. Hawkins); Nonsuch High School, 23.viii.1993 (R. Hawkins).
- Harmonia 4-punctata* **cream-streaked ladybird**: Nonsuch Park, beaten from pine, 1.viii. 1993, 23.viii.1993, 29.viii.1993 (R. Hawkins).
- Propylea 14-punctata* **14-spot ladybird**: Nonsuch Park, adult and larvae on goosefoot/orache, 23.viii.1993 (R. Hawkins); Cherry Orchard Farm, on hogweed, 4.vii.1993; Banqueting House, on sycamore keys, 1.viii.1993, beaten from trees, 29.viii.1993 (R. Hawkins); Surrey County Council, beaten from trees, 29.viii.1993 (R. Hawkins); Warren Farm, on grass and red clover, 13.vi.1993, 1.viii.1993 (R. Hawkins).
- Myrrha 18-guttata* **18-spot ladybird**: Nonsuch Park, beaten from pine, 1.viii.1993, 29.viii.1993 (R. Hawkins).
- Calvia 14-guttata* **14-spot ladybird**: Nonsuch Park, beaten from lime, 23.viii.1993 (R. Hawkins); Surrey County Council strip, beaten from sycamore, 2.v.1993 (R. Hawkins); Warren Farm, on thistle under trees, 16.v.1993 (R. Hawkins).
- Thea 22-punctata* **22-spot ladybird**: Nonsuch Park, adult and larvae on goosefoot/orache, 23.viii.1993 (R. Hawkins); Cherry Orchard Farm, on hogweed, 2.v.1993 (R. Hawkins); Banqueting House, on thistles, 1.viii.1993 (R. Hawkins); Warren Farm, on clover, 2.v.1993, on trefoil leaves, 4.vii.1993, abundant adults and some larvae on mildewed leaves of Canadian golden rod and other plants, 29.viii.1993 (R. Hawkins).

FAMILY PYROCHROIDAE — cardinal beetles

- Pyrochroa serraticornis* **cardinal beetle**: Cherry Orchard Farm, in damp woodland, 16.v.1993 (R. Hill).

FAMILY OEDEMERIDAE

- Oedemera lurida*: Cherry Orchard Farm, on hogweed flowers, 4.vii.1993, 1.viii.1993 (R. Hawkins); Warren Farm, from grass and composites, 13.vi.1993, swept from red clover, 29.viii.1993 (R. Hawkins).

FAMILY CERAMBYCIDAE — longhorn beetles

- Brammoptera ruficornis*: Banqueting House, beaten from Norway maple, 16.v.1993 (R. Hawkins); Surrey County Council strip, beaten from sycamore, 2.v.1993 (R. Hawkins).

Leptura livida: Cherry Orchard Farm, both sexes on hogweed flowers, 4.vii.1993. (R. Hawkins).
Strangalia melanura: Cherry Orchard Farm, 4.vii.1993 (R. Hawkins).

FAMILY CHRYSOMELIDAE — leaf beetles

Chrysolina hypericic: Warren Farm, on common St John's-wort, 4.vii.1993 (R. Hawkins).
C. staphylaea: Cherry Orchard Farm, 2.v.1993 (J. Chatfield, det. R. Hawkins).
Gastrophysa polygoni: Nonsuch Park, on knotgrass, Mansion House, 23.viii.1993 (R. Hawkins).
Phaedon tumidulus: Cherry Orchard Farm, on hogweed, 4.vii.1993 (R. Hawkins).
Lochmaea crataegi: Warren Farm, on hawthorn, 2.v.1993 (R. Hawkins).
Sermylassa halensis: Warren Farm, 29.viii.1993 (R. Hawkins).
Cassida rubiginosa: Warren Farm, on creeping thistle, 13.vi.1993 (R. Hawkins).

FAMILY ATTELABIDAE

Rhynchites aequatus: Nonsuch Park, on Swedish whitebeam, 1.viii.1993 (R. Hawkins); Warren Farm, on hawthorn, 2.v.1993 (R. Hawkins).

FAMILY APIONIDAE

Apion malvae: Cherry Orchard Farm, on mallow, 4.vii.1993 (R. Hawkins); Warren Farm, many on mallow, 13.vi.1993 (R. Hawkins).
A. aeneum: Cherry Orchard Farm, on mallow, 4.vii.1993 (R. Hawkins); Warren Farm, on mallow, 13.vi.1993 (R. Hawkins).
A. radiolus: Cherry Orchard Farm, 4.vii.1993 (R. Hawkins); Warren Farm, on mallow, 13.vi.1993 (R. Hawkins).

FAMILY CURCULIONIDAE — weevils

Phyllobius maculicornis: Cherry Orchard Farm, 16.v.1993; Warren Farm, 2.v.1993, 13.vi.1993 (R. Hawkins).
P. pomaceus: Cherry Orchard Farm, on nettles, 2.v.1993 (R. Hawkins).
P. pyri: Cherry Orchard Farm, 2.v.1993; Banqueting House, 16.v.1993; Warren Farm, 2.v.1993.
P. roboretanus: Cherry Orchard Farm, 16.v.1993; Warren Farm, 13.vi.1993.
P. viridiaeris: Warren Farm, 13.vi.1993.
Strophosomus melanogrammus: Warren Farm, 29.viii.1993.

Plant galls

The galls are listed according to host plant genus, alphabetically as in the *Provisional keys to British plant galls*, edited by F. B. Stubbs (1986). Sometimes the same species of gall organism forms galls of different appearance on a different part of the host plant — these represent sexual and asexual stages of the life history.

The list includes records made during the survey days and other occasions in 1993 and also collected by Miss Frances Wright and Miss Doris Hutchings in 1992. Identifications are by Dr June Chatfield and Mr John Ockenden. These are all common species, but add another dimension to natural history studies at Nonsuch.

Acer — sycamore and field maple

Eriophyes macrochelus — mite gall on field maple. Nonsuch Park, 28.viii.1993.
E. macrorhynchus cephalonea — mite gall on field maple. Nonsuch Park, 28.viii.1993.
E. macrorhynchus — mite gall on sycamore leaves. Cherry Orchard Farm, 1.v.1993.

Cirsium — thistles

Euribia cardui — gall-fly in thistle stem. Cherry Orchard Farm, 7.x.1993; Warren Farm, 29.viii.1993.

Quercus — oak

Andriscus quercuscalicis — **knopper gall** on acorns caused by a gall-wasp. Nonsuch Park 29.viii.1993; Surrey County Council, strip, viii.1992 (F. Wright).
A. fecundator — **artichoke gall** on oak bud caused by a gall-wasp. Surrey County Council strip, 29.viii.1993.
Cynips quercus-folii — **cherry gall** caused by gall-wasp on oak leaf. Surrey County Council, viii.1992 (F. Wright).
Neuroterus numismalis — **silk button gall** on underside of oak leaves caused by a gall-wasp. Nonsuch Park, 29.viii.1993, Surrey County Council, viii.1992 (F. Wright).

N. quercusbaccarum — **common spangle gall** on underside of oak leaves caused by a gall-wasp. Nonsuch Park, 29.viii.1993, Surrey County Council, 29.viii.1993.

N. quercusbaccarum — **currant gall** on oak catkins caused by a gall-wasp. Surrey County Council, 2.v.1993.

Biorhiza pallida — **oak-apple** on oak buds caused by a gall-wasp. Surrey County Council, viii.1992 (F. Wright), 2.v.1993.

Andriscus kollari — **oak marble gall** on oak bud caused by a gall-wasp. Surrey County Council, 29.viii.1993; Nonsuch High School, 23.viii.1993.

Rosa — rose

Diplolepis rosae — **robin's pincushion** or **bedequer** on rose leaf caused by a gall-wasp. Surrey County Council, viii.1992 (F. Wright).

Taxus — yew

Taxomyia taxi — gall-fly on bud of yew. Nonsuch Park, 29.viii.1993.

Tilia — lime

Eriophyes exilis — mite galls on leaves of lime. Nonsuch Park, 29.viii.1993.

E. tiliae typica — **nail gall** of mite on leaves of lime. Nonsuch Park, 29.viii.1993.

Ulmus — elm

Eriophyes campestricola — **blister gall** of mite on elm leaves. Nonsuch Park, 29.viii.1993; Cherry Orchard Farm (Avenue), 2.v.1993; Warren Farm, 2.v.1993; Nonsuch High School, 23.viii.1993.

Veronica — speedwell

Jaapiella veronicae — gall on bud of Speedwell caused by a gall-fly. Warren Farm, 4.ix.1992 (D. Hutchings); Nonsuch High School, 23.viii.1993.

Reptiles and amphibians

Common lizards, known from Warren Farm and the surrounds of Nonsuch High School (Heather Sharpe *in litt.*) in the 1950s, have been seen at Warren Farm in recent years by Frances Wright, and were photographed in 1989 by Mike Ford. They prefer sandy soil and seek out sunny bare patches to bask in the sun along footpaths. Slow-worms are often on chalky soils where they feed on slugs and snails, but they are more secretive and more likely to be hidden away under old logs. Both prefer open sites with limited disturbance and for this reason the railway line is probably a stronghold for the population and of great importance to their future survival. The Warren Farm site is unusual since Langton (1991) recorded very few sites in the London Area which had both common lizards and slow-worms, although they coexist elsewhere.

Common frogs and toads occur in Nonsuch and tadpoles were seen in the Round Pond in May 1993. With their dependence on water for breeding, frogs, toads and newts will be affected by long-term drought and the new and larger pond by the Ewell gate should prove a useful habitat. A special search should be made to locate these animals on future field work and to assess their status and breeding sites, with special reference to newts.

REPTILES

Slow-worm *Anguis fragilis*: Seen near Warren Farm, 1989 (F. Wright).

Common lizard *Lacerta vivipara*: Seen at Warren Farm (F. Wright), 12.v.1991 (J. Byatt and Croydon Natural History and Scientific Society), and on railway embankment alongside, 1993 (P. Knipe).

AMPHIBIANS

Common smooth newt *Triturus vulgaris*: Once occurred (1950s) in several ponds including that at Bluegates (J. Chatfield and J. Wright).

Great crested newt *T. cristatus*: In 1950s in the 'Brown Pond' situated in a copse at end of drainage Channel near Sparrow Farm Road entrance (J. Chatfield).

Common frog *Rana temporaria*: 1993 (J. Wright and R. Hawkins). Tadpoles in Round Pond, 16.v.1993 (J. Chatfield).

Common toad *Bufo bufo*: Seen occasionally 1990–3 (F. Wright).

Birds

The section is mostly records pre-1990 and includes a list from the late Dr Desmond Seymour for 1971–93, records from the late Mr C. B. Ashby for 1951–92, London Natural History Society *Atlas* survey, 1968–72 (Montier 1977), the Misses Frances and Jean Wright 1988–9, Surrey Bird Club 1992 (Mr Jeffery Wheatley), field records of Mr Vic Howard, Surbiton and District Bird Watching Society 1993 and 1994 (Mr Peter Denney), British Naturalists' Association field meetings 1992–3 (Miss Doris Hutchings), and some made during the 1993 surveys. Many are by local residents who walk in Nonsuch regularly.

Names are in the order and format of *An atlas of the birds of the western Palearctic* (Harrison 1982). The summary for each species was prepared by Frances Wright, using indications of national population trends from the BTO survey (Merchant et al. 1990).

* no longer at Nonsuch.

Grey heron *Ardea cinerea*: D. Seymour; i.1980 (Surbiton and District Bird Watching Society); Nonsuch Park near newly-dug pond, 29.viii.1993 (R. Hawkins and F. Wright). Seen occasionally in Nonsuch Park by newly-dug pond, and on Warren Farm near gardens. Local status in line with national situation of slow increase.

Mute swan *Cygnus alor*: D. Seymour.

Rare visitor to Nonsuch, not breeding. Nesting attempt in 1970s failed due to disturbance. Nationally stable.

Canada goose *Branta canadensis*: D. Seymour.

Visits, still infrequent in Nonsuch, are a new occurrence of recent years and attracted to newly-dug pond. Nationally and for London there is a strong increase.

Mallard *Anas platyrhynchos*: D. Seymour; breeding (Montier 1977); 1988–9 (F. and J. Wright).

Little breeding success in recent years due to greater disturbance although reported as breeding in 1968 (London Natural History Society). Nationally stable after a period of increase.

Sparrowhawk *Accipiter nisus*: D. Seymour; Cheam Park 7.ii.1987, 31.i.1988 (C. B. Ashby); Nonsuch High School wood and playing fields, 9.xii.1990; at great height but clearly identifiable 25.iii.1992 (C. B. Ashby), Nonsuch Park, Mansion House garden, 7.x.1993 (J. Chatfield); 3.i.1993 (Surbiton and District Bird Watching Society).

Much increased in Nonsuch area and could be breeding by railway line on Warren Farm, where often seen by walkers. General increase locally, nationally sustained recovery probably now completed and fall since 1984.

Hobby *Falco subbuteo*: D. Seymour (rarity and overflier).

Rare overflier, three sightings in local tetrads in 1988 (LNHS). Nationally increasing, but setbacks in recent years.

Kestrel *Falco tinnunculus*: D. Seymour; Montier (1977); 1988–9 (F. and J. Wright); pair in boundary wood, 21.iv.1989, boundary wood by recreation ground, adult and two juveniles, 28.viii.1989 (C. B. Ashby); J. J. Wheatley 1992, present and probably breeding; Warren Farm, 5.ix.1992, 24.iv.1993 (D. Hutchings), 13.vi.1993 (R. Hawkins, M. Kemp and F. Wright); Nonsuch High School, pair, probably breeding, 23.viii.1993 (V. Howard, R. Hawkins, F. Wright). Frequently seen during years 1990–3 by F. and J. Wright. Nests and calls of young in 'Bird Sanctuary' and 'The Wood' in Nonsuch Park, from trees on Surrey County Council strip and from railway embankment by Warren Farm; 3.i.1994 (Surbiton and District Bird Watching Society) seen by them most years.

Present all year and seen frequently, sometimes in courtship flight display. This bird is the motif of Nonsuch Watch. Breeding in Nonsuch Park and Warren Farm and possibly Cherry Orchard Farm. Probably all the Nonsuch habitat spaces are full by now. Increase in recent years and locally over 20 years. Nationally stable or slightly declining.

***Common partridge** *Perdix perdix*: Anon. (1934) *Country-Side* magazine; covey 16.ix.1951 (C. B. Ashby); calling at dusk, 5.iv.1953 (C. B. Ashby); heard calling after dusk from Cheam Recreation Ground, 26.v.1953 (C. B. Ashby); calling Cheam Recreation Ground, 23.iv.1958 (C. B. Ashby).

Present in Nonsuch in the 1950s when the park was still farmed, but due to change of land use no longer seen. Two local breeding records in 1968, but none since then. Nationally severe long-term decrease.

Common pheasant *Phasianus colchicus*: Seen by F. and J. Wright — a pair seeming to be nesting on Cherry Orchard Farm in 1993 and heard previously in same location. Pair seen at Cherry Orchard Farm in 1993, perhaps breeding. A decline locally (recent LNHS records) and nationally wild populations declining, but increased numbers reared.

Common coot *Fulica atra*: D. Seymour.

Stable or slightly decreasing in Nonsuch in recent years, but never abundant. Breeding, but not more than three or four pairs. Young seen but chicks soon disappear. Few suitable habitats in Nonsuch. Locally and nationally increasing.

Moorhen *Gallinula chloropus*: D. Seymour; Montier (1977), bred on a small pond; Nonsuch Park, Newly-dug pond, hen with young, 13.vi.1993 (R. Hawkins, F. Wright and M. Kemp), pair seen, 1.viii.1993 (V. Howard, R. Hawkins, F. Wright).

On small pond and newly-dug pond. Often present, attempts at breeding but limited success due to disturbance. Young hatch but short survival. Elsewhere locally successful breeding, probably stable nationally.

Lapwing *Vanellus vanellus*: D. Seymour (rarity and overflier); Warren Farm, three flocks, 30 each, 3.i.1994 (P. Denney/Surbiton and District Bird Watching Society).

Rarely seen in Nonsuch since farming ceased, but flocks occasionally seen on Warren Farm. Rare locally and nationally a marked downward trend.

Black-headed gull *Larus ridibundus*: D. Seymour; 3.i.1993, 3.i.1994 (P. Denney), seen most years.

Regular flocks visit wet fields in park every winter. Stable population visiting here and Cheam Recreation Ground. No national information given in BTO survey.

Herring gull *L. argentatus*: 3.i.1993, 3.i.1994 (P. Denney) seen a number of years. Not a regular visitor.

Lesser black-backed gull *L. fuscus*: D. Seymour; seen a number of years (Surbiton Bird Watching Society).

Occasionally with flocks of black-headed gulls at Nonsuch Park.

Common gull *L. canus*: D. Seymour.

Rarely seen at Nonsuch.

Woodpigeon *Columba palumbus*: D. Seymour; breeding (Montier 1977), F. and J. Wright breeding in Nonsuch Park and Warren Farm 1988–9; J. J. Wheatley 1992 present and apparently breeding; 3.i.1994 (P. Denney) (usually seen).

In Nonsuch everywhere breeding and abundant, but may be a slight decline. Nationally recovering since decline of 1970s.

Stock dove *C. oenas*: 26–8.xii.1980, 20–30; 22.iii.1987, 2 pairs; 24.viii.1989 pair in boundary wood by recreation ground, display by male (C. B. Ashby); J. J. Wheatley 1992, present and apparently breeding, calling from nest hole; Warren Farm on old tree, female seen disappearing into hole so probably breeding 4.vii.1993 (R. Hawkins and F. Wright).

Tentative presence but now breeding again. Not numerous. At Warren Farm and Nonsuch Park. Recent LNHS records show slight increase in breeding in local area and marked increase in sightings. Nationally stable after partial recovery from decline.

Feral pigeon: F. and J. Wright 1988–9, breeding in Nonsuch Park and Warren Farm.

Collared dove *Streptopelia decaocto*: D. Seymour; Montier (1977), F. and J. Wright 1988–9, breeding in Nonsuch Park and Warren Farm. J. J. Wheatley 1992, present and apparently breeding among houses on north side of the park; 3.i.1993, 3.i.1994 (P. Denney) (seen some years).

Breeding, a sustained population since at least 1988. Seen in all parts of Nonsuch and large increase locally from 1968 of this introduced species. Nationally stable following large increase.

Turtle dove *S. turtur*: F. and J. Wright 1988–9, Nonsuch Park and Warren Farm. Rarely seen at Nonsuch, but mainly Warren Farm. Uncommon locally and not breeding since 1988. Nationally in recent decline.

Cuckoo *Cuculus canorus*: D. Seymour.

Heard regularly in 1950s and 1960s, especially in London Road plantation. Now rare. Nationally probably in decline.

Little owl *Athene noctua*: seen flying over Surrey County Council strip, 4.vii.1993 (R. Hawkins and F. Wright), 1993 (Y. Canter).

Though abundant in 1950s, absent for next 40 years, may be set to re-establish itself in Nonsuch following two sightings in 1993.

Tawny owl *Strix aluco*: D. Seymour; breeding Montier (1977); F. and J. Wright 1988–9 Nonsuch Park, probably breeding on Warren Farm; 27.viii.1990, calls from boundary wood after sunset, 16.xii.1991 (C. B. Ashby).

Heard in park and on wilder sites and breeding by Banqueting House and Cherry Orchard Farm. Locally in decline as large trees are lost and only now breeding in six local tetrads. Nationally decreased since 1970s, but stabilized at lower level.

Common swift *Apus apus*: D. Seymour; breeding Montier (1977); F. and J. Wright 1988–9, breeding in Nonsuch Park and Warren Farm; J. J. Wheatley 1992, feeds over the area. In by 16.v.1984, gone by 16.viii.1984; in by 15.v.1985, gone by 15.v.1985, 136 recorded for 1984, 102 for 1985 (V. Howard).

Usually prolific in Nonsuch, both in the park and Warren Farm, but not so many seen in 1993. Breeding locally at least from 1968–88 and fledgling found in garden in North Cheam in 1994 where it breeds in houses of 1930s. A decline in breeding locally from 1968 to 1988 which fits with decline in numbers of birds seen. Nationally it may be stable, but the BTO state that it is difficult to census.

Kingfisher *Alcedo atthis*: D. Seymour (rarity and overflier).

Extremely rare. Passing birds might stop at the ponds. Breeding in few places locally and nationally in decline.

Great spotted woodpecker *Dendrocopos major*: D. Seymour; probably breeding Montier (1977); F. and J. Wright 1988–9, breeding in Nonsuch Park and Warren Farm; J. J. Wheatley 1992; 5.ix.1992, 24.iv.1993 drumming (D. Hutchings); 3.i.1993 (P. Denney) seen most years; Warren Farm, three flying together, 13.vi.1993 (R. Hawkins, M. Kemp and F. Wright); Nonsuch Park, one seen, 1.viii.1993 (R. Hawkins, F. Wright and V. Howard).

Successful in Nonsuch in all parts and thought to be breeding. Family groups seen in Warren Farm and courting displays in park woodland. It may benefit from feeding birds in surrounding suburban gardens. Nationally it may be declining from high levels in 1970s and 1980s.

Lesser spotted woodpecker *D. minor*: D. Seymour; probably breeding Montier (1977), Nonsuch Park, 9.ix.1975, 2 seen, 10.ix.1975, 29.ix.1975, heard (C. B. Ashby); Nonsuch 15.i.1985, 6.iii.1985, pair seen, 24.iv.1985, 4.x.1985, 12.iii.1986 (V. Howard); F. and J. Wright 1988–9, probably breeding in Nonsuch Park and Warren Farm; Warren Farm 5.ix.1992 (D. Hutchings); 3.i.1993, 3.i.1994 (P. Denney) seen a number of years.

Present all year and seen fairly often, probably breeding on the wilder land where it is more often seen than the park. Locally stable.

Green woodpecker *Picus viridis*: D. Seymour; Montier (1977); F. and J. Wright 1988–9, breeding in Nonsuch Park and Warren Farm; J. J. Wheatley 1992, bred in the park at the north end; Nonsuch Park, by newly dug-pond, male seen by nest hole, 13.vi.1993 (R. Hawkins and F. Wright); Nonsuch Park in flight, 1.viii.1993 (R. Hawkins, F. Wright and V. Howard), 7.x.1993 (J. Chatfield); Surrey County Council strip, 28.viii.1993 (J. Chatfield); Warren Farm, 5.ix.1992, 24.iv.1993 (D. Hutchings); 3.i.1993, 3.i.1994 (P. Denney) seen most years.

Very successful in all parts of Nonsuch and this was the case in the 1950s also. All territorial spaces are now probably full with a stable population over recent years. The drumming on tree-trunks and yaffle call are a feature of walks in Nonsuch. A decline locally due to loss of breeding sites and some decline nationally.

Skylark *Alauda arvensis*: D. Seymour; breeding Montier (1977); Warren Farm 26–8.xii.1980, c.100 on unploughed stubble, 22.ii.1987, at least 50, 5.xii.1988, 14 in a pre-roosting flight (C. B. Ashby); F. and J. Wright 1988–9, breeding on Warren Farm; J. J. Wheatley 1992, breeding on Warren Farm; Warren Farm, 5.ix.1992, 24.iv.1993 (D. Hutchings); P. Denney 3.i.1993; Warren Farm, many seen, 13.vi.1993 (R. Hawkins, F. Wright and M. Kemp); Warren Farm, 2.v.1993, 7.x.1993 (J. Chatfield); Cherry Orchard Farm, 2.v.1993, 16.v.1993 (J. Chatfield).

On the wing singing over Warren Farm and occasionally over Cherry Orchard Farm but only breeding on Warren Farm. Its range on the Nonsuch sites has declined since the end of farming and increased disturbance by walkers and dogs. Warren Farm is the stronghold of this species in the district. It is in decline in other areas around London and a sharp decline in local breeding records. Potentially endangered.

***Woodlark** *Lullula arborea*: Nonsuch Park (Grid reference TQ/229636) one seen singing over stubble, song and appearance diagnostic, watched c. 10 minutes, 16.ix.1951 (C. B. Ashby).

Noted in 1951 in farmed area but no longer seen at Nonsuch. In decline nationally.

Swallow *Hirundo rustica*: D. Seymour; breeding Montier (1977); 124 seen in 1984, 65 in 1985. In by 12.vi.1984, gone by 26.ix.1984, in by 15.v.1985, gone by 8.x.1985 (V. Howard); F. and J. Wright 1988–9, probably breeding in Nonsuch Park and Warren Farm.

Nonsuch Park by the Mansion House, Warren Farm and Cherry Orchard Farm. Seen in large numbers in some recent years flying low and hunting with swifts and house martins. Not so prolific in the last two to three years. Probably not breeding here now and much decline in breeding locally. Nationally in decline.

House martin *Delichon urbica*: D. Seymour, breeding Montier (1977), F. and J. Wright 1988–9 probably breeding in Nonsuch Park and Warren Farm.

Infrequent in Nonsuch, but sometimes as a few individuals with swallows and swifts feeding over fields in Nonsuch Park and Warren Farm. Probably not breeding as breeding is in decline locally. Nationally stable.

Meadow pipit *Anthus pratensis*: D. Seymour; Nonsuch Park, c.18 on field of rough grass, 10.x.1954 (C. B. Ashby); Warren Farm, c.10 at dusk — thin bill seen against the sky, 24.ii.1991 (C. B. Ashby).

Small flocks seen in recent years on Warren Farm, but not known if they breed. A drastic decline locally and nationally.

- Pied wagtail** *Motacilla alba*: D. Seymour; Montier (1977); two in 1986 (V. Howard); F. and J. Wright 1988–9, Nonsuch Park and Warren Farm.
Seen in Nonsuch fairly frequently on lawns and short grass in the park. Probably stable locally, breeding not known, nationally populations are fluctuating.
- Yellow wagtail** *M. flava*: D. Seymour.
Nationally declining and only one sighting so presence doubtful.
- Grey wagtail** *M. cinerea*: D. Seymour; 1984 (Surbiton Bird Watching Society).
Rare for Nonsuch. Seen in Cheam Park by the pond, i.1988 (C. B. Ashby). Declining nationally.
- Dunnock** *Prunella modularis*: D. Seymour; breeding Montier (1977); F. and J. Wright 1988–9, breeding in Nonsuch Park and Warren Farm; 3.i.1993 (P. Denney) seen most years.
All areas of Nonsuch, well distributed and breeding. Stable population present all year. Nationally declining.
- Garden warbler** *Sylvia borin*: F. and J. Wright 1988–9 seen in Nonsuch Park, heard on Surrey County Council strip, but not in main park, probably breeding on Warren Farm.
Seen on Surrey County Council strip, Banqueting House and Cherry Orchard Farm in particular and sometimes in the park. Stable but not prolific, probably declining at a slow rate. Nationally recovering from decline of 1970s.
- Blackcap** *S. atricapilla*: D. Seymour; probably breeding Montier (1977); one seen in 1984 and 1985 (V. Howard); F. and J. Wright 1988–9, probably breeding in Nonsuch Park and Warren Farm; J. J. Wheatley 1992, present and apparently breeding; 11.v.1984, 18.vi.1984, 4.vii.1984, 4.viii.1984, 17.iv.1985, 1.v.1985, 8.v.1985, 15.v.1985 (V. Howard); Warren Farm for first time in 1994 (Surbiton Bird Watching Society), Warren Farm, in song by railway line, 16.v.1993 (J. Chatfield), male probably breeding — territorial song and behaviour, 13.vi.1993 (R. Hawkins).
Increased in Nonsuch at Warren Farm and Cherry Orchard Farm, song often heard. Breeding. Nationally increasing.
- Common whitethroat** *S. communis*: Nonsuch Park, pair carrying food, 2.vi.1953 (C. B. Ashby); D. Seymour; breeding Montier (1977); Cherry Orchard Farm, singing from low tree and probably breeding, April 1993 (F. and J. Wright).
Not evident on a regular basis, breeding. Singing and territorial behaviour in Cherry Orchard Farm but not in the more disturbed areas of the park. Reported breeding in Nonsuch in 1977. Its breeding is in decline locally, but stable in small numbers at Nonsuch. Nationally fluctuating around a new lower level.
- Lesser whitethroat** *S. curruca*: D. Seymour; probably breeding Montier (1977).
Mostly in Cherry Orchard Farm, rare for Nonsuch. Locally it appears that the bird is stable and Nonsuch may be an important site. No clear national trend.
- Chiffchaff** *Phylloscopus collybita*: D. Seymour; probably breeding Montier (1977); 11.vii.1984, 12.ix.1984 (V. Howard); F. and J. Wright 1988–9, breeding in Nonsuch Park and Warren Farm; J. J. Wheatley 1992, present and apparently breeding; Nonsuch Park 'Bird Sanctuary' 3.v.1993 (J. Chatfield); Cherry Orchard Farm woods, 2.v.1993 (J. Chatfield).
Most often heard in the central oak plantation in early spring. Not prolific but probably stable. Nationally increasing after a decline in 1970s.
- Willow warbler** *P. trochilus*: D. Seymour; probably breeding Montier (1977); F. and J. Wright 1988–9, breeding on Warren Farm.
On Surrey County Council strip and prolific most recent summers. Breeding. Unmistakeable descending song heard often on this site. Nonsuch is probably a stronghold locally. Nationally little long-term change.
- Goldcrest** *Regulus regulus*: D. Seymour; probably breeding Montier (1977); three in 1984, five in 1995 (V. Howard); F. and J. Wright 1988–9, breeding in Nonsuch Park and Warren Farm; J. J. Wheatley 1992; 3.i.1994, seen most years, six in 1986 (Surbiton and District Bird Watching Society).
Nonsuch Park and Surrey County Council strip mostly, small groups seen. Often in the wooded part of the Mansion House garden and the conifers along The Avenue. Breeding. Nationally recovering from population crash in 1986.
- Spotted flycatcher** *Muscicapa striata*: D. Seymour; breeding Montier (1977); one in 1985 (V. Howard); F. and J. Wright 1988–9, seen in Nonsuch Park and Warren Farm, but more abundant in the latter.
Cheam Park and Nonsuch Park. Seen breeding but not numerous. Locally sharply declining and national trend is also downwards.
- Robin** *Erithacus rubecula*: D. Seymour; breeding Montier (1977); F. and J. Wright 1988–9, breeding in Nonsuch Park and Warren Farm; J. J. Wheatley 1992, present and apparently breeding; Warren Farm, 5.ix.1992, 24.iv.1993 (D. Hutchings); 3.i.1993, 3.i.1994 (P. Denney) every year.

Mistle thrush *Turdus viscivorus*: D. Seymour; breeding Montier (1977); F. and J. Wright 1988–9, breeding in Nonsuch Park and Warren Farm; J. J. Wheatley 1992, bred in the park; Warren Farm, 24.iv.1993 (D. Hutchings); P. Denney and Surbiton Bird Watching Society, 3.i.1993, 3.i.1994, most years; Nonsuch Park, 1.viii.1993 (R. Hawkins, F. Wright and V. Howard), flock seen, 1.viii.1993 (P. Denney).

All areas and especially hedges of Cherry Orchard Farm. Abundant in family groups. Breeding. Slight increase locally against a steady decline nationally.

Fieldfare *T. pilaris*: occasional in winter, D. Seymour; 1982 and 1983 (Surbiton Bird Watching Society); flocks seen 1985 and 1986 (V. Howard).

Winter visitor to fields of Warren Farm and sometimes Nonsuch Park where it seems to be declining.

Redwing *T. iliacus*: occasional in winter (C. B. Ashby); flocks seen in 1985 and 1986 (V. Howard); 3.i.1993, 3.i.1994 six seen (P. Denney), most years.

Mostly a winter visitor to Warren Farm, occasionally in Nonsuch. Stable nationally.

Song thrush *T. philomelos*: D. Seymour; breeding Montier (1977); 124 in 1984, 94 in 1985 (V. Howard); F. and J. Wright 1988–9, breeding in Nonsuch Park and Warren Farm; J. J. Wheatley 1992, present and apparently breeding; Warren Farm, 5.ix.1992, 24.iv.1993 (D. Hutchings); P. Denney 3.i.1994, most years.

All parts of Nonsuch but declining throughout district and nationally.

Blackbird *T. merula*: D. Seymour; breeding Montier (1977); F. and J. Wright 1988–9, breeding in Nonsuch Park and Warren Farm; J. J. Wheatley 1992, present and apparently breeding; 3.i.1993, 3.i.1994, every year (P. Denney and Surbiton Bird Watching Society); Warren Farm, 24.iv.1993 (D. Hutchings).

Breeding in all areas of Nonsuch. Stable locally with many nesting locations. Nationally fluctuating with no overall trend.

Long-tailed tit *Aegithalos caudatus*: D. Seymour; breeding Montier (1977); F. and J. Wright 1988–9, breeding in Nonsuch and Warren Farm; 3.i.1994 (Surbiton Bird Watching Society), most years.

Thriving in all areas of Nonsuch and very often seen on Surrey County Council strip. Breeding. Increasing locally, no overall trend nationally.

Blue tit *Parus caeruleus*: D. Seymour; breeding Montier (1977); F. and J. Wright 1988–9, breeding in Nonsuch Park and Warren Farm; J. J. Wheatley 1992, present and believed to breed; 3.i.1993, 3.i.1994 (P. Denney), seen every year; Warren Farm, 24.iv.1993 (D. Hutchings).

Often seen on Surrey County Council strip and other wilder areas. Breeding. Stable locally, nationally fluctuating.

Coal tit *P. ater*: D. Seymour; breeding Montier (1977); F. and J. Wright 1988–9, probably breeding in Nonsuch Park and Warren Farm; Surrey County Council strip, 1.viii.1993 (R. Hawkins, F. Wright and V. Wallace); 1994, two (V. Howard); 3.i.1994 (Surbiton Bird Watching Society), seen almost every year.

Frequently seen in pine trees in Nonsuch park and hedgerow along Surrey County Council strip, often with blue tits. Not abundant but stable. Nationally relatively stable at new higher density.

Willow tit *P. montanus*: breeding Montier (1977).

Never abundant in past few decades. Nationally no clear trend.

Great tit *P. major*: D. Seymour; breeding Montier (1977); F. and J. Wright 1988–9, breeding in Nonsuch Park and Warren Farm; 3.i.1993, 3.i.1994 (P. Denney), every year; Warren Farm, 24.iv.1993 (D. Hutchings).

Distinctive call in all woodland areas, widespread but not abundant. Stable locally and nationally.

Nuthatch *Sitta europaea*: D. Seymour; Montier (1977); F. and J. Wright 1988–9, breeding in Nonsuch Park and Warren Farm; 3.i.1993, 3.i.1994 (P. Denney), every year.

Holding its own in Nonsuch, although locally recorded breeding sites are down. Seen in all areas, but particularly park woodland and Surrey County Council strip. National long-term increase.

Treecreeper *Certhia familiaris*: D. Seymour; probably breeding Montier (1977); F. and J. Wright 1988–9, breeding in Nonsuch Park and Warren Farm; 3.i.1994 (Surbiton Bird Watching Society), most years.

Seen in all woods and copses. A secretive bird that is more abundant than is apparent, but seen by patient observers. Breeding stable in Nonsuch, but few other tetrads locally. There is a national overall increase with fluctuations relating to the winter weather.

Wren *Troglodytes troglodytes*: D. Seymour; breeding Montier (1977); F. and J. Wright 1988–9 breeding in Nonsuch Park and Warren Farm; J. J. Wheatley 1992, bred in the park; 3.i.1993, 3.i.1994 (P. Denney), a number of years.

In all areas and breeding with stable population. Nationally recovering from crash in 1960s, but with fluctuations.

Reed bunting *Emberiza schoeniclus*: Warren Farm, 21.ii.1987, two seen, 22.ii.1987, five, 1.iii.1987, eight, 22.iii.1987, one (C. B. Ashby); Nonsuch Park, D. Seymour.

Nationally a steep decline, 1975–83, stable at lower end.

Yellowhammer *Emberiza citrinella*: D. Seymour; seen in breeding season Montier (1977); one in 1985 (V. Howard); F. and J. Wright 1988–9, seen in Nonsuch Park, breeding on Warren Farm.

A bird of open country, which is infrequent on Warren Farm, and old hedges, rarely elsewhere. Breeding in 1988, but present situation doubtful. Breeding in only two local tetrads. Nationally stable.

Brambling *Fringilla montifringilla*: Warren Farm, 21.ii.1987, one male in flock of mixed passerines (C. B. Ashby).

Chaffinch *Fringilla coelebs*: D. Seymour; breeding Montier (1977); F. and J. Wright 1988–9, breeding in Nonsuch Park and Warren Farm; J. J. Wheatley 1992, present and apparently breeding; Warren Farm 5.ix.1992, 24.iv.1993 (D. Hutchings); 3.i.1993, 3.i.1994 (P. Denney and Surbiton Bird Watching Society), seen in a number of years.

Fairly abundant and breeding, but may have declined in the park due to overcutting of hedges. Nationally a slow increase following recovery from 1960s crash.

Bullfinch *Pyrrhula pyrrhula*: D. Seymour; breeding Montier (1977); 17 dates between 16.v.1984 and 26.iii.1985 (V. Howard); F. and J. Wright 1988–9, breeding in Nonsuch Park and Warren Farm; in a number of years, six in 1982 (Surbiton Bird Watching Society).

Edges of Warren Farm and Cherry Orchard Farm and breeding. Often reported in nearby gardens. Slight increases locally, national trend declining since 1970s.

Goldfinch *Carduelis carduelis*: D. Seymour; breeding Montier (1977); F. and J. Wright 1988–9, breeding in Nonsuch Park and Warren Farm; Warren Farm 5.ix.1992 (D. Hutchings); 3.i.1993 (P. Denney), a number of years; Warren Farm 13.vi.1993, many seen (R. Hawkins, M. Kemp, F. Wright).

Increasing on Cherry Orchard and Warren Farms with increase in thistles. Many seen in flocks. Breeding. Nonsuch population stable, but nationally showing steep decline outside farmland.

Greenfinch *C. chloris*: D. Seymour, breeding Montier (1977), F. and J. Wright 1988–9 breeding in Nonsuch Park and Warren Farm, J. J. Wheatley 1992, present and apparently breeding; Warren Farm, 5.ix.1992 (D. Hutchings); most years (Surbiton Bird Watching Society).

Seen in all parts of Nonsuch, abundant and breeding. Nationally stable, though small downward trend.

Siskin *C. spinus*: D. Seymour; occasional in winter Nonsuch Park in Japanese larch (five), 2.iii.1986 (C. B. Ashby); five seen in 1985 (V. Howard).

Winter visitor in all sites, declining and not abundant. Nationally increasing due to afforestation.

Linnet *Acanthis cannabina*: Nonsuch Park, 11.iv.1953 singing male, nest in hedge in same site 3.v.1953, hen sitting — Cheam Recreation Ground, 22.ii.1987 c.40 on fields near north boundary with Nonsuch Park (C. B. Ashby); D. Seymour, breeding Montier (1977); 1985 (V. Howard); F. and J. Wright 1988–9 seen in Nonsuch Park, breeding in Warren Farm; Warren Farm, flock of c.15, 3.i.1993, one in 1981 (P. Denney and Surbiton Bird Watching Society).

A rarity. On fields, especially Cherry Orchard Farm and Warren Farm and occasionally in the park. May still breed on wilder land. Locally stable but a serious national decline.

Redpoll *Acanthis flammea*: Nonsuch Park, occasional in winter, feeding on birch catkins in plantation (23), 8.xii.1985 (C. B. Ashby); three in 1984 (V. Howard).

Rare in Nonsuch, not breeding and locally uncommon.

House sparrow *Passer domesticus*: D. Seymour; breeding Montier (1977); F. and J. Wright 1988–9, breeding in Nonsuch Park and Warren Farm; J. J. Wheatley, 1992, present and apparently breeding; 3.i.1993, 3.i.1994 (P. Denney), every year.

Abundant in all sites, breeding and stable. Adjacent housing provides breeding sites and food supply. Stable locally, nationally in some decline.

Tree sparrow *P. montanus*: breeding Montier (1977); Warren Farm 26–8.xii.1980 c.20 (C. B. Ashby); one in 1981 (Surbiton and District Bird Watching Society); F. and J. Wright 1988–9 breeding in Nonsuch Park and Warren Farm.

Widespread and breeding on all sites. Stable but only occasional. Nationally in strong decline.

Starling *Sturnus vulgaris*: D. Seymour; breeding Montier (1977); F. and J. Wright 1988–9, breeding in Nonsuch Park and Warren Farm; J. J. Wheatley 1992, bred in the park; 3.i.1993, 3.i.1994 (P. Denney), most years.

Abundant in all sites, breeding and stable. Nationally a marked decline since 1960s.

Jay *Garrulus glandarius*: D. Seymour; probably breeding Montier (1977); F. and J. Wright 1988–9, breeding in Nonsuch Park and Warren Farm; J. J. Wheatley, 1992, present and believed to breed; 3.i.1993, 3.i.1994 (P. Denney), most years; Nonsuch Park by Brown Pond, 3.v.1993 (J. Chatfield); Warren Farm, 24.iv.1993 (D. Hutchings).

May be slightly increasing over last two or three years, especially on Surrey County Council strip. Breeding and locally increasing. Nationally stable.

Maggie *Pica pica*: Nonsuch Park, 16.ix.1951, one seen, 5.iv.1953, two seen — at that time scarce enough to warrant noting (C. B. Ashby); D. Seymour; breeding Montier (1977); F. and J. Wright 1988–9, breeding in Nonsuch Park and Warren Farm; J. J. Wheatley, 1992, present and believed to breed; 3.i.1993, 3.i.1994 (P. Denney), every year; Nonsuch Park, 2.v.1993, 26.vi.1993 (J. Chatfield); Warren Farm, 24.iv.1993 (D. Hutchings).

Family groups seen in all areas, breeding. A familiar sight nowadays, but not common in 1950s. Nationally a steady increase.

***Rook** *Corvus frugilegus*: In 1950s, Nonsuch Park (J. Chatfield).

Not seen in Nonsuch nowadays and not breeding locally. Nationally some recovery from serious decline.

Carriion crow *C. corone*: D. Seymour; breeding Montier (1977); F. and J. Wright 1988–9, breeding in Nonsuch Park and Warren Farm; J. J. Wheatley, 1992, bred in the park; 3.i.1993, flock c.20, 3.i.1994 (P. Denney); Nonsuch Park by Ewell gate, 25.vi.1993, 28.viii.1993, 7.x.1993 (J. Chatfield); Warren Farm, 24.iv.1993 (D. Hutchings).

Doing well in all areas and nationally increasing.

Jackdaw *C. monedula*: Montier (1977); 3.i.1994 (Surbiton Bird Watching Society).

A rare visitor to Nonsuch and few local breeding sites. Nationally increasing.

Mammals

The bulk of the report is based on records by Ian Beames prior to 1990: a new survey and small-mammal trapping needs to be undertaken. Although described in earlier reports, rabbits and brown hares no longer occur at Nonsuch.

Hedgehog *Erinaceus europaeus*: Seen killed along A24 adjacent to Nonsuch Park (I. Beames). Seen at Warren Farm and Nonsuch Park but decreasing rapidly, even in local gardens, 1988 (F. Wright).

Mole *Talpa europaea*: Molehills seen in Nonsuch Park on the Thanet Sands, mostly along the Avenue (J. Chatfield 1950s and 1993; Jean Wright 1988; F. Wright 1994) Cherry Orchard Farm by Avenue, molehills, 2.v.1993 (J. Chatfield); Banqueting House grass, molehills, 2.v.1993 (J. Chatfield).

Noctule *Nyctalus noctula*: One or two on summer evenings flying high over the main area (I. Beames).

Pipistrelle *Pipistrellus pipistrellus*: Several records, and colony of over 70 in house tiles in road adjacent to the park (I. Beames). Sightings in flight — once quite frequent at Warren Farm, now rare (F. Wright 1988).

Rabbit *Oryctolagus cuniculus*: Present in Nonsuch Park until the end of the 1950s (Frank Tait and June Chatfield). Frances Wright reports no evidence of them now.

Brown hare *Lepus capensis*: Recorded in the article in *Country-Side* (Anon. 1934) for 1930s. Not present now.

Grey squirrel *Sciurus carolinensis*: Reported as numerous (I. Beames). Nonsuch Park, gardens of Mansion House, 28.viii.1993 (J. Chatfield), Nonsuch Park 7.x.1993 (J. Chatfield).

Bank vole *Clethrionomys glareolus*: In copses and hedges along A24. Less widespread than wood mouse (I. Beames). Warren Farm — evidence of small holes in banks, but animals not seen (F. Wright 1988).

Wood mouse *Apodemus sylvaticus*: Present in all the copses right up to the hedge along the A24 (I. Beames). Sighting at Warren Farm, 1992 (F. Wright).

Fox *Vulpes vulpes*: Quite common (I. Beames). It occurs in gardens in the surrounding suburban area of West Ewell (J. Chatfield 1992) and in Cheam (F. Wright 1994). Seen passing through Warren Farm, 1988 (F. Wright) and a fox cub by the railway in 1988 (F. Wright).

Species totals for the Nonsuch sites

| Plants etc. | | | Animals | | |
|------------------|-----|-----------|------------------|-----|-----------|
| Fungi | 78 | (1989–93) | Slugs and snails | 43 | (1993) |
| Lichens | 41 | (1983) | Woodlice | 6 | (1993) |
| Mosses | 65 | (1973–93) | Spiders | 44 | (1993) |
| Liverworts | 6 | (1973–93) | Harvestmen | 8 | (1993) |
| Ferns | 1 | (1988–93) | Pseudoscorpions | 1 | (1993) |
| Horsetails | 1 | (1988–93) | Insects | 360 | (1993) |
| Conifers | 2 | (1988–93) | Amphibians | 4 | (1956–93) |
| Flowering plants | 260 | (1988–93) | Reptiles | 2 | (1988–93) |
| Plant galls | 16 | (1992–93) | Birds | 75 | (1977–93) |
| | | | Mammals | 8 | (1970–93) |

Grand total 1,021 species

Discussion

The present survey represents only an interim report on the flora and fauna of the Nonsuch open spaces. Some groups like molluscs and bryophytes are unlikely to yield many more species, whilst much remains to be done in some of the insect groups, fungi and lichens. Field work to cover all areas of the open space will fill in some gaps and enable more precise comparisons to be made. A number of groups are highly seasonal in their occurrence so sequential field surveys are necessary across the year. Further monitoring will also pick up the natural fluctuations and cycles in populations and also any long-term trends.

Field results showed a difference in the flora and fauna as well as the landscape character between the main sections, namely Nonsuch Park, Cherry Orchard Farm and Warren Farm. The prime cause of this is the geology, with chalk closest to the surface at Warren Farm providing conditions for chalk-loving species. Snails are more abundant on the calcareous soils. Certain species of plants and animals would be most unlikely to occur on the acid London Clay that forms the northern part of Nonsuch Park. The underlying rocks also impose their influence on the moisture levels of the habitats. London Clay is very wet in winter, but can be baked hard in dry summer weather when moisture-loving creatures like snails would be at a disadvantage. Moisture levels may also affect the bryophyte and lichen floras.

Until the 1960s the land use of almost all the open spaces in Nonsuch was farmland and the land has a long history of such human disturbance. There would have been farmland surrounding the medieval village of Cuddington that was destroyed for the building of Nonsuch Palace, and, after a period as deer-park, it reverted to farmland at the end of the seventeenth century. In this history it has similarity with another London fringe open space — Horsenden Hill Country Park, near Ealing — which was farmed, but is now amenity land (Game, Archer and Frith 1988; Ealing Borough Council n.d.). It has similarities in the geology, in the presence of London Clay, but differences in having areas of gravel. Another large open space on the fringes of south-east London that featured in *The London Naturalist* is Shooter's Hill and Oxleas Wood in Kent (Burton 1992). This differs from the other two open spaces in that it includes much ancient woodland. Like Nonsuch it has been under threat from development (road building — the East London River Crossing) and was the subject of several public inquiries in recent years (Black 1993). Nonsuch lacks the rich ancient-woodland element of Shooter's Hill/Oxleas Wood, but instead has a robust range of species compatible with public amenity use. Further discussion on management will follow.

The woodland belts and copses of Nonsuch are relatively small, and although probably present for several centuries they do not have ancient-woodland species. London Clay tends to dry out and there is little depth of leaf litter to preserve ground-level moisture for invertebrates. The earlier predominance of elm did not give a persistent leaf-litter layer and the more recently-established sycamore has similar characteristics — but there is some ground-living invertebrate woodland life none the less.

The Wood, on the Cheam Recreation Ground boundary, does support the shrubby plant spurge laurel *Daphne laureola*, and this is an area where chalk comes near to the surface and influences the flora and fauna. A dog's mercury sward, typical of older woods, is in Cherry Orchard Farm and this was also found to be the richest area for species of bryophytes and molluscs. The different levels of vegetation and habitats in the woods provide much opportunity for insects. The invertebrates, fungi, lichens and bryophytes all benefit from dead wood being left *in situ*. A policy of over tidiness would be detrimental to the flora and fauna, and it is good to see old logs and branches around.

The last cereal growing was at Warren Farm in 1986. In 1989 the land was sold by the Inner London Education Authority (who had held it in reserve for potential sports ground) to a developer and this led to a planning application for houses. This was refused and there have been two public inquiries dealing with Nonsuch. At the first of these, the local authority tried to establish Green Belt designation for the entire Nonsuch area, but a stronger protection than this was sought by local people, fearing a golf course development within Nonsuch. Frances Wright made a case for the people of Cheam that this was their last piece of countryside, and sought to prevent any more change. The Green Belt application was denied, due to the inspector believing it was inapplicable for an area surrounded by housing, but she did recommend high protection for Nonsuch, and acknowledged the wildlife interest. The second inquiry dealt solely with Warren Farm where the owners put forward a 'compromise' of giving the majority of the 64-acre site to a conservation body in return for permission to build on 10½ acres adjacent to existing housing. Their alternative plans would have included a proposal for formal sports on the whole site, which they argued was not precluded by the decision of the earlier inquiry. Such a plan would have meant the end of the last Nonsuch skylark habitat and a drastically reduced diversity of flora and fauna.

Since the end of farming there has been no management to Warren Farm and the site is one in transition, with splendid shows of poppies in 1991. Now however alien species are coming in from nearby gardens and Canadian golden rod has established. In the long term, sycamore saplings will need to be controlled if the area is not to follow a natural succession through scrub to secondary deciduous woodland.

Another element that is limited at Nonsuch is marshy wetland, though the small ponds and newly-dug one by the Ewell gate provide a valuable addition of a freshwater habitat. Pond-dipping by children is a highly educational activity and in my own childhood at the edge of Nonsuch, the pond-life was a major attraction. The land round Bluegates Pond in an old clay-pit on the edge of Cherry Orchard Farm, well-known to local children in the 1940s and 1950s for its exceptionally rich newt population, has been built next to and is now overgrown (Frances and Jean Wright pers. comm.).

Great crested newts, one of the rarer species, used to occur in the Brown Pond. This newt is capable of living in garden ponds provided they are deep enough and it is hoped that it may have survived in surrounding gardens when the Brown Pond dried out in drought years. The newly-dug pond could provide a habitat, should a residual population survive.

The Round Pond as shown on the map of 1731 (Dent 1981) may have been a watering place for working farm animals. It is in the open and now surrounded by well-grown willows, but a photograph taken by the author in 1955 shows how much the willows have grown in the last forty years. The smaller ponds (Brown Pond, Sanctuary Pond and Ostracod Pond — my names) are in copses connected to drainage ditches and receive little light as well as having fallen leaves deposited in them. It would be interesting to know more about recent changes in water-tables and its effect on water in the ponds. Freshwater life is an area for future survey work, although the pond snails were covered in the 1993 surveys. One snail, a small ram's-horn *Anisus leucostoma* seems to have been lost since the early 1960s and prolonged drought is probably the cause. A survey of pond-life would be a useful future activity.

One of the main advantages of the collective Nonsuch sites is the comparatively large area (c.400 acres) of open space with a diversity of geology, habitat and degree

of management. Nonsuch Park is the only area with ponds, but the park on its own would be much diminished in natural history interest, both scientifically as a resource for biodiversity and aesthetically as an amenity area, without the variety provided by the adjacent Nonsuch sites. The wide open horizon of Warren Farm and the singing of skylarks overhead is much valued by local residents as an antidote to the artificial materialistic pressures of suburban life. The present size of the collective Nonsuch sites provides living space for the fauna, a larger and more genetically viable population and greater ecological stability, helping it to fight back against setbacks of weather and human activity. The natural world has remarkable recuperative powers — but there are limits to this. Management is about understanding and respecting those limits. In the abstract, the author, being acutely aware of the masses of houses surrounding Nonsuch, describes it as ‘an oasis of countryside’. In the term ‘oasis’ is implied a refreshing and welcome change in the more open and natural Nonsuch countryside. Fortunately Epsom and Ewell are not so densely built up as Cheam, and to the south are green spaces around Ewell village and its churchyard, through the Hogsmill Valley and further on to link with Epsom Common, Ashted Woods and the North Downs of the Surrey countryside. These areas could function as wildlife corridors preventing genetic isolation and so should be actively protected. It would be interesting to compare the species lists of Epsom Common and Ashted Woods across more groups, as Roger Hawkins has started with the ladybirds. An isolated habitat is unlikely naturally to regain species once they are lost.

Management

All three of the main Nonsuch open spaces are a valuable asset to the area both for the range of native species they support, the habitats and the countryside character of the landscape. It would be a very serious loss if any of this be destroyed by development or managed in such a tidy way as to resemble a municipal town park with short mown grass and a drastically reduced biodiversity — tidy but sterile. Preservation of this piece of countryside and maintenance of the diversity of species and habitats must underlie management in all areas.

Nonsuch Park

This area is under the control of the Nonsuch Park Joint Management Committee. At some time in the recent past there was a tendency for overenthusiastic mowing and the deleterious effect of this was picked up in the flowering plants and insects. Grasshoppers in particular, whose stridulating calls are part of the summer countryside, need long grass and are soon reduced by over mowing. A report in 1991 from the Trust for Urban Ecology, for Nonsuch Watch, recommended less mowing and allowing the plants in the meadows to flower and seed. Whilst some urban people may not like long grass in late summer, a little shagginess is necessary to maintain biodiversity.

Various recorders picked up the importance of leaving dead wood to rot *in situ*, as a range of species depend on this resource. With the end of arable farming, Nonsuch is down to grass: wild flowers, butterflies, birds and other wildlife can now be looked upon as the ‘crop’ to be nurtured as Nonsuch is an amenity area rather than a working farm. This also has the advantage of freedom from pesticides and artificial fertilizers. As the main attraction of Nonsuch is its countryside character, non-native species should not be planted except in the Mansion House garden. There are some fine exotic trees in Cheam Park (subject of an earlier London Natural History Society field meeting, Appendix 1) which relate to that area once being the surround of a large house destroyed in the Second World War. The Mansion House gardens are attractive in their own right and also offer some habitats and different species, like the liverwort *Porella platyphylla* growing on the wall. This area would merit further study.

Cherry Orchard Farm

No longer used for farming, market gardening or clay extraction, this area has been unmanaged and is covered by rank wayside vegetation like hogweed. The wildlife has

benefited from this, and it is an interesting area for the naturalist, but some management will be needed to halt the eventual succession to secondary sycamore woodland, the seed supply being readily at hand from existing mature trees. The woodland behind is a rich wildlife site and should be left as it is. Children riding bicycles in the clay-pits have created paths and bare ground which add to the variety of habitat in a way that has been beneficial to mosses.

Cherry Orchard Farm was purchased in the 1930s by the Borough of Epsom and Ewell at a time when vast areas of land had been lost to housing. It was kept in farm or market garden use with a public footpath to the Banqueting House site. There is now uncertainty over the future of this site, following recent coverage in the local newspapers with pressure for it to be partly developed as a sports facility. It would be a great loss to the biodiversity and natural amenity of the Nonsuch sites if this were to happen and it is suggested that more people are likely to benefit from it as a public open space. The Recreation Department should appreciate that informal recreation and countryside, and protecting it for future use, should come under their remit too.

A management plan should be drawn up for Cherry Orchard Farm for informal recreation and wildlife resource as an extension of the park, but in a way that does not make it a tamed landscape. It is already used a good deal by walkers and bird-watchers.

Warren Farm

With the end of farming (cereal growing) in 1986 there has been no management of this site. It is in a stage of transition and the dominant flowering plants vary from year to year. Canadian golden rod which seeds freely and has escaped from nearby gardens has established. Whilst this plant supports an interesting insect community in North America (Root and Cappuccino 1992) and is favoured as a nectar source by many insects, it is not native and is also invasive and thus could be eliminated. Although there is public footpath access crossing Warren Farm the public have made other paths and walked freely across the area, and these paths provide useful habitat diversity and basking sites for insects and lizards. One of the main attractions of this area is the open aspect, skylarks and freedom from traffic noise. Skylarks used to occur over much of Nonsuch, but they are now restricted to Warren Farm. Management to prevent succession to secondary sycamore woodland and opposition to formal sport use of the site will be necessary to retain the skylarks which have shown considerable reduction in the London fringes in recent years. Other wildlife specialities of Warren Farm which need to be considered in the management are the slow-worms and common lizards, two other species in decline in Greater London. Their reservoir population seems to be on the railway line, a situation observed throughout the London Area where other lizard habitats have been depleted (Langton 1991).

The few dead isolated trees are valuable habitats for insects, spiders and birds and should also be retained. Meadow management of the land with various paths crossing would enable an interesting and contrasting range of plants to occur. Because of its geology and higher topography, this area will always be different in character and a much valued part of the collective Nonsuch open space.

Designation

Nonsuch has a country character and a native species diversity greater than heavily-maintained sites closer to London. Because it is on the fringes and on a bus route, it is accessible to many people. It is hoped that this report will highlight the natural history interest of the Nonsuch sites and generate a resolve to preserve its biodiversity of habitats, species and landscape. The local group Nonsuch Watch exists to promote the wildlife and countryside character of the Nonsuch open spaces and it is hoped that further survey work will take place.

To encourage deeper thought into sensitive management and bringing in the experience and expertise of conservation bodies like English Nature, the wildlife trusts, Trust for Urban Ecology, London Ecology Unit and British Trust for Conservation

Volunteers to help in management, designation of the site either as a Local Nature Reserve (like Oxleas Wood) or as a Site of Nature Conservation Importance would be a useful step in protecting this local asset and maintaining the biodiversity of the London fringe in the international spirit of the Earth Summit in Rio de Janeiro, the Biodiversity Convention being recently endorsed by this country. Had Nonsuch been within the boundaries of London, the London Ecology Unit (*in litt.*) is of the opinion that it would merit designation as a Site of Metropolitan Importance.

Conclusion

A general account of London's natural history and the factors affecting it were outlined in a New Naturalist book (Fitter 1945), which helps in the assessment of Nonsuch. The present survey has shown that the Nonsuch open space has a good range of common and local species of plants and animals and in some groups (spiders and insects) nationally notable species are present. It is not however a site full of such species and this is not to be expected on London Basin geology with a history of farming. National rarities are often those of narrow-range habitats or poor colonizers, and examples are chalk downland, bog, fen and ancient woodland, which do not occur at Nonsuch.

However this is a place where nature conservation and informal recreation can exist side by side provided that it is managed sensitively. The common species should not be undervalued as they provide simple pleasures that enhance the lives of many local people who look and see. Ox-eye daisies bring great enjoyment to those taking summer walks in the fields of Nonsuch and should be cherished and protected as one of the assets of the place. Likewise, shows of poppies and other colourful wild flowers have been appreciated at Warren Farm where they stimulated the work of local artists. As Richard Mabey (1993) appropriately states in his book *The common ground*

'Rare species may also be of great scientific interest, particularly if they are located in isolated pockets that may represent the last remnants of more widespread populations. And none of us is immune to the excitement and sense of privilege at meeting what another generation of naturalists called "curiosities".

'But it is the *common* species that keep the living world ticking over and provide most of our everyday experiences of wildlife and I would argue that maintaining the existence of these is as important a conservation priority as maintaining the existence of rarities.'

The common species are particularly suitable for educational purposes and for developing a caring appreciation of the living world in the next generation. The recollections of those who grew up around Nonsuch quoted in an earlier section of this paper endorse the value of natural open spaces like Nonsuch on the lives of children, providing them with attitudes and experiences that they carry with them throughout their lives.

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FURTHER RECORDS

The author would be pleased to receive further records of plants and animals from Nonsuch, either as historical records, present records or indication of an interest in taking part in future field work.

NONSUCH WATCH

Nonsuch Watch is a local group which campaigns for the natural countryside character of the Nonsuch open spaces. It aims to preserve the quiet amenity, semi-natural countryside and the natural history interest. For details, send an s.a.e. to Frances Wright, Rushbrooke, 192 Church Hill Road, Cheam, Surrey SM3 8NQ.

APPENDIX 1

Exotic trees

Exotic trees of Nonsuch Park and Cheam Park recorded on a field meeting of the London Natural History Society led by Mr Bryan Radcliffe on 26 September 1982. Most of the time was spent in Cheam Park which is unusually rich in exotics, but also including the Mansion House gardens and a small larch plantation nearby in Nonsuch Park.

CHEAM PARK

CYCADS

Maidenhair tree *Ginkgo biloba*: China.

CONIFERS

Algerian cedar, Atlas cedar *Cedrus atlantica*: Atlas Mountains of Algeria and Morocco.

Blue Atlas cedar *C. atlantica* 'glauc': Atlas Mountains of Algeria and Morocco.

Deodar or Himalayan cedar *C. deodara*: Western Himalayas and Afghanistan.

Japanese red cedar *Cryptomeria japonica*: China and Japan.

Smooth Arizona cypress *Cupressus glabra*: USA, central Arizona.

Monterey cypress *C. macrocarpa*: North America, California.

Hybrid Dunkeld larch *Larix* × *eurolepis*: not found native as parent species do not overlap in the wild.

Sweet gum *Liquidambar styraciflua*: USA.

Dawn redwood or water fir *Metasequoia glyptostroboides*: SW China.

Wellingtonia, big tree or Sierra redwood *Sequoiadendron giganteum*: Sierra Nevada, USA.

Swamp or bald cypress *Taxodon distichum*: USA.

BROADLEAVES

- Red snake-bark maple** *Acer capillipes*: From Japan. (One of this group is mis-labelled *A. forrestii*).
- Cappadocian maple** *A. cappadocicum*: Asia — Caucasus Mountains, Hindu Kush, Himalayas, China.
- Norway maple** *A. platanoides*: Europe to Caucasus. Naturalized in southern England. (Misnamed 'silver maple' on label). Self-sown seeds in copse and on other side of park.
- Silver maple** *A. saccharinum*: North America.
- Indian horse chestnut** *Aesculus indica*: Asia — Himalayas.
- Italian alder** *Alnus cordata*: southern Italy and Corsica.
- Cut-leaved silver birch** *Betula pendula* 'dalecarlica': southern Sweden. A natural variant.
- Clerodendron trichotomum*: China.
- Cornelian cherry** *Cornus mas*: central and southern Europe.
- Broad-leaved cockspur thorn** *Crataegus* × *prunifolia*: unknown origin.
- Dove tree, ghost tree, handkerchief tree** *Davidia involucrata*: western China.
- Honey locust** *Gleditsia triacanthos*: USA — Midwest.
- Common walnut** *Juglans regia*: SE Europe to China, naturalized in parts of England.
- Tulip tree** *Liriodendron tulipifera*: North America.
- Common or black mulberry** *Morus nigra*: western Asia.
- Dombey's southern beech** *Nothofagus dombeyi*: South America.
- Roble beech** *N. obliqua*: South America.
- Black Italian poplar** *Populus* × *euramericana* 'serotina': not a natural species.
- Chinese necklace poplar** *P. lasiocarpa*: China.
- Lombardy poplar** *P. nigra* 'italica': Italy.
- Hybrid balsam poplar** *Populus*: close to *P. trichocarpa*, but petiole too long. Possibly *P. trichocarpa* × *P. tacamahaca*.
- Tibetan cherry** *Prunus serrula*: Eastern China.
- Red oak** *Quercus borealis* ?var. *maxima*: North America.
- Scarlet oak** *Q. coccinea*: USA.
- Hungarian oak** *Q. frainetto*: Europe, Balkans to Italy. Leaves larger than common oak with more, and more-regular lobes.
- Holm oak** *Q. ilex*: North Africa to southern Europe. A very variable species. Becoming naturalized on chalk of southern England.
- Cypress oak** *Q. robur* 'fastigiata': Central Europe.
- Rose acacia hybrid?** *Robinia*: close to *R. hispida*, but flowers too small.
- White willow** *Salix alba*: Europe, north Africa, central Asia.
- Weeping willow** *S. alba* 'tristis': France.
- Contorted willow** *S. matsudana* 'tortuosa': China.
- Bastard service tree** *Sorbus* × *thuringiaca*: eastern Europe.

NONSUCH PARK

CONIFERS

- Noble fir** *Abies procera*: USA — Washington — Oregon.
- Japanese larch** *Larix kaempferi*: Japan.
- Beach pine or shore pine** *Pinus contorta* var. *contorta*: North America — Alaska to California.
- Maritime pine** *P. pinaster*: Mediterranean.
- Bhutan pine** *P. wallichiana*: Afghanistan to Nepal, Asia.
- Douglas fir** *Pseudotsuga menziesii*: North America — British Columbia, California, Rocky Mountains, Mexico.
- Coast redwood** *Sequoia sempervirens*: Oregon to California, USA.
- Western red cedar** *Thuja plicata*: western North America — Alaska, California, Idaho.
- Western hemlock** *Tsuga heterophylla*: North America.

BROADLEAVES

- Sweet/yellow buck-eye** *Aesculus flava*?: SE USA.
- June berry** *Amelanchier lamarckii*: eastern N. America. Becoming naturalized in southern England.
- Hybrid catalpa** *Catalpa erubescens*: USA — Indiana — man-made hybrid (*C. ocata* × *C. bignonioides*).
- Judas tree** *Cercis siliquastrum*: southern Europe — western Asia.
- Cut-leaf beech or fern-leaf beech** *Fagus sylvatica* 'heterophylla': selected variant — Europe.
- Cucumber tree** *Magnolia acuminata*: USA.
- Evergreen magnolia** *M. grandiflora*: SE Asia.
- Sessile or durmask oak** *Quercus petraea*: western Asia and Europe, including Britain.

APPENDIX 2

Flowering plants at Nonsuch c.1934, recorded by Richard Fitter

Meadow buttercup *Ranunculus acris*
 Common water crow-foot *R. aquatilis* agg.
 Common poppy *Papaver rhoeas*
 Common mouse-ear *Cerastium fontanum*
 *Sticky mouse-ear *C. glomeratum*
 White campion *Silene latifolia*
 Common sorrel *Rumex acetosa*
 Perforate St John's wort *Hypericum perforatum*
 Common mallow *Malva sylvestris*
 Early dog-violet *Viola reichenbachiana*
 Field pansy *V. arvensis*
 Field penny-cress *Thlapsi arvense*
 Creeping cinquefoil *Potentilla reptans*
 *Barren strawberry *P. sterilis*
 Dog-rose *Rosa canina*
 Common vetch *Vicia sativa*
 *?Lucerne *Medicago sativa*
 Hop trefoil *Trifolium campestre*
 Least trefoil *T. dubium*
 Red clover *T. pratense*
 Dovesfoot cranesbill *Geranium molle*
 Ivy *Hedera helix*
 Cow parsley *Anthriscus sylvestris*
 Lesser burdock *Arctium minus*
 *Wild parsnip *Pastinaca sativa*
 White dead-nettle *Lamium album*
 Ground ivy *Glechoma hederacea*
 *Wild basil *Clinopodium vulgare*
 *Wild marjoram *Origanum vulgare*
 *Wild clary *Salvia verbenaca*
 Common field speedwell *Veronica persica*
 Lady's bedstraw *Galium verum*
 Hedge bedstraw *G. mollugo*
 *Marsh cudweed *Gnaphalium uliginosum*
 Mugwort *Artemisia vulgare*
 Coltsfoot *Tussilago farfara*
 Lords-and-ladies *Arum maculatum*
 Cocksfoot grass *Dactylis glomerata*
 Meadow foxtail grass *Alopecurus pratensis*
 *Black grass *A. myosuroides*

* Not found in recent survey.

The majority of these species were also recorded in the recent surveys with the exception of sticky mouse-ear, marsh cudweed, wild parsnip, wild basil, lucerne, wild marjoram, wild clary, barren strawberry and black grass. These include two elements, the arable weeds and chalkland flora which are both in decline at Nonsuch: the latter were presumably found on the edges of Warren Farm.

APPENDIX 3

Heteroptera of Nonsuch recorded by E. W. Groves

Extracted from Groves, E. W., Hemiptera-Heteroptera of the London Area, as serialized in *The London Naturalist*, 43-65, 1964-1986.

Order HEMIPTERA, suborder HETEROPTERA

Family NABIDAE — damsel bugs

Nabis flavomarginatus 8.vii.1955
 (= *Nabicula flavomarginata*) 13.viii.1954

| | | |
|------------------------------|--------------|----------------------------|
| <i>Nabis rugosus</i> | 13.viii.1954 | |
| <i>Aptus mirmicoides</i> | 13.viii.1954 | |
| <i>Himacerus apterus</i> | 22.vii .1955 | IV instar larva |
| | 13.viii.1954 | adult ♂ and V instar larva |
| <i>Dolichonabis limbatus</i> | 8.vii .1955 | IV instar larva |
| (= <i>Nabacula limbata</i>) | 22.vii .1955 | adult and IV instar larva |
| | 13.viii.1954 | adult ♀ |

Family ANTHOCORIDAE — flower bugs

| | |
|----------------------------|--------------|
| <i>Anthocoris confusus</i> | 22.vii .1955 |
| <i>Anthocoris nemorum</i> | 22.vii .1955 |

Family MIRIDAE — plant bugs

| | | |
|-----------------------------------|--------------|--|
| <i>Deraeocoris lutescens</i> | 22.vii .1955 | |
| <i>Deraeocoris ruber</i> | 22.vii .1955 | |
| <i>Megalocoleus molliculus</i> | 22.vii .1955 | |
| <i>Amblytylus nasutus</i> | 8.vii .1955 | |
| <i>Psallus diminutus</i> | 8.vii .1955 | |
| <i>Psallus varians</i> | 22.vii .1955 | |
| <i>Plagiognathus albipennis</i> | 8.vii .1955 | |
| <i>Plagiognathus arbustorum</i> | 22.vii .1955 | |
| <i>Plagiognathus chrysanthemi</i> | 8.vii .1955 | |
| | 22.vii .1955 | |
| | 13.viii.1954 | |
| <i>Heterotoma planicornis</i> | 22.vii .1955 | |
| <i>Blepharidopterus angulatus</i> | 22.vii .1955 | V instar larva |
| <i>Orthotylus viridinervis</i> | 8.vii .1955 | on wych elm |
| <i>Orthotylus marginalis</i> | 8.vii .1955 | |
| | 13.viii.1954 | |
| <i>Orthotylus flavinervis</i> | 13.viii.1954 | |
| <i>Orthotylus flavosparsus</i> | 22.vii .1955 | |
| <i>Pithanus maerkeli</i> | 22.vii .1955 | V instar larva |
| <i>Lygus rugulipennis</i> | 8.vii .1955 | |
| | 13.viii.1954 | |
| <i>Liocoris tripustulatus</i> | 22.vii .1955 | ♂♂, ♀♀ and V instar larvae |
| <i>Lygocoris viridis</i> | 8.vii .1955 | |
| | 13.viii.1954 | |
| <i>Lygochoris contaminatus</i> | 13.viii.1954 | |
| <i>Charagochilus gyllenhalii</i> | 22.vii .1955 | V instar larva |
| <i>Calocoris fulvomaculatus</i> | 13.viii.1954 | |
| <i>Calocoris norvegicus</i> | 8.vii.1955 | |
| | 22.vii .1955 | |
| | 13.viii.1954 | |
| <i>Adelphocoris lineolatus</i> | 8.vii.1955 | V instar larvae |
| | 22.vii .1955 | ♂ & ♀ adults, V, IV, III instar larvae |
| | 13.viii.1954 | adult and V instar larvae |
| <i>Megacoelum infusum</i> | 13.viii.1954 | |
| <i>Stenotus binotatus</i> | 8.vii .1955 | adult and III instar larva |
| | 22.vii .1955 | adult and V instar larva |
| <i>Phytocoris dimidiatus</i> | 13.viii.1954 | |
| <i>Capsus ater</i> | 8.vii .1955 | |
| <i>Stenodema calcaratum</i> | 22.vii .1955 | III instar larva |
| <i>Notostira elongata</i> | 22.vii .1955 | III instar larva |
| <i>Leptopterna dolabrata</i> | 8.vii .1955 | ♂ |
| | 13.viii.1954 | ♀ |

Total 38 species

APPENDIX 4

An interpretation of the insects of Nonsuch in 1993, by R. D. Hawkins

Introduction

Seven field meetings were held at Nonsuch Park during 1993, in order to record insects and other creatures at different seasons. Besides Nonsuch Park itself, coded NP in the species lists, various peripheral areas were included in the survey: Cherry Orchard Farm (CO), the Banqueting House (BH), Warren Farm (WF), Nonsuch School wildlife area (NS), and the wooded strip along the old road owned by Surrey County Council (SW).

The lists report the records of Roger Hawkins, assisted by Victor Wallace and members of Nonsuch Watch, but further lists of insects for 1993 have also been provided by Peter Harvey, Ian Menzies, and Ron Boyce with Rosemary Hill. Most attention was paid to ladybirds and some other families of beetles, to grasshoppers and crickets, and to the heteropteran bugs, or at least their terrestrial forms, and insects from many other groups were noted when found. As far as possible, insects were named in the field, but individual specimens were taken when this was necessary for their identification. Brief field notes are provided for most species listed. These often confirm the known habits of the insect, or represent a casual occurrence near the normal habitat, but it is just possible that the collection of numerous records of this sort may point towards the discovery of some unknown habit.

At present (November 1993), many specimens are still waiting to be identified, so this report is now issued in provisional form, with species lists for only the main groups studied.

Ladybirds

These small colourful beetles were recorded as part of an ongoing survey of the county of Surrey, based on listing all species within areas of standard size (2 km squares). The square including most of Nonsuch Park now has eighteen species recorded for it, and ranks as the equal second best recorded site in Surrey for these insects. The reason is the diversity of habitat. Most species that are typical of broad-leaved woodland, grassland or tall herbaceous plants, were found frequently, especially in the peripheral areas such as Warren Farm. Several additional species restricted to coniferous trees such as pine and larch, or to wet places, occurred in Nonsuch Park itself. Heathland is the only habitat missing from Nonsuch which might provide further species, so sites including heath may eventually yield more species than Nonsuch, if recorded as thoroughly. On the other hand, there are still a few more species that may yet be awaiting discovery at Nonsuch. The list contains mostly common species, but the Adonis's ladybird, found near the Mansion House gardens, is classified as nationally scarce (Nb). A large population of the pine ladybird is present on the trunks of the horse chestnut trees which form an avenue leading from the Ewell gate. This is a new association for this species, and its behaviour on these trunks is the subject of ongoing research.

Soldier beetles

The ten species listed are all rather common except for the tiny *Malthinus balteatus* which is classed as nationally scarce (Nb). The list shows clearly the sequence of different species occurring as adults at different times of year.

Click beetles

These insects are difficult to record, since the adults of many species spend much of their time on or even under the ground. Five species were found, three very common ones and two others. *Cidnopus minutus* and *Athous hirtus*, which are widespread but local.

Grasshoppers and crickets

The grasshoppers proved disappointing, in that of three species expected, only two were found. The missing species is the common green grasshopper *Omocestus viridulus* which is found in natural grassland throughout the British Isles. It can survive in small patches of long grass, but has

limited powers of recolonization, and has probably been eliminated at Nonsuch at some time in the past by the regular mowing of all areas of grassland.

The bush-crickets however are well represented, with all three widespread species present, and also two nationally scarce species that have spread considerably in recent years. The oak bush-cricket, up in the trees, and the speckled bush-cricket, which prefers bushy margins, seem to be common at Nonsuch. They both extend further into the built-up area than this. The dark bush-cricket is here on the edge of its distribution, which reaches from Epsom and Ewell along the River Hogsmill, and just into the western side of Cherry Orchard Farm. This is a pleasing find, since it was not marked as present here on the map of Surrey Orthoptera now being prepared for publication, and also since it is absent from Sutton, Banstead and the area south of Epsom.

Roesel's bush-cricket was restricted largely to the Essex coast of the Thames Estuary until the hot summers of the 1980s, when a remarkable spread took it all around the outskirts of London. It is now present in quantity in the tall vegetation of Warren Farm and Cherry Orchard Farm, where Ian Menzies has estimated its abundance more closely. He also used his bat detector to discover the long-winged conehead at Warren Farm; the faint call of this species had eluded even the sharp ears of Nonsuch Watch members. Until quite recently, this species was restricted to parts of the south coast, but another extraordinary spread has taken it up through the New Forest and right across outer Surrey, and now into Nonsuch Park.

Dragonflies

The new pond near the Ewell gate is clearly the main breeding site for dragonflies in the area, with the azure damselfly being the dominant species. We listed eight species, but the records for previous years, which were made by Brad Ashby and reported by Stephen Brooks, bring the total to eleven. Other species should be present. The most likely ones are the migrant hawk which flies late in the year, at which time we did not manage to revisit the pond, and the common blue damselfly. We thought we saw some of these flying over the water, but they would not come close enough for their identity to be confirmed.

Heteropteran bugs

Students of bugs are fortunate in having the comprehensive paper by E. W. Groves on Hemiptera–Heteroptera of the London Area, published in sixteen parts by the London Natural History Society, to serve as a reference against which to compare any new findings. The present survey may be seen in perspective using his summary and discussion from Part XVI in *The London Naturalist* 65(1986), pages 119–178.

Eric Groves visited Nonsuch Park himself to record bugs on three occasions, in August 1954 and July 1955. He confined his studies to the Surrey CC wooded strip (SW), which was then less wooded and more open. He found 38 species of Heteroptera there, and these are listed in Appendix 3 to this report. Only 28 of his species were found in the 1993 survey, although many of them, being characteristic of grassland or other low vegetation, had moved out into Warren Farm and other areas. Several of the remainder are common species that have probably been overlooked, leaving only about four species as possible losses.

Through covering the whole of Nonsuch Park and its adjoining areas, and also by visiting at different times of year, the 1993 survey recorded 80 species of Heteroptera, so giving a total of 90 from the two lists together. Groves also lists the totals recorded at different sites. Pre-eminent locally is Bookham Common with 205 species; this site has been recorded intensively over a long period by many entomologists for the LNHS. Other totals given are for Ashted Common and Wood (100), Epsom Common (49), Banstead Downs (41) and Mitcham Common (64). This suggestion that Nonsuch Park may be a better wildlife site than Epsom Common, may cause surprise in some quarters. However, Groves suggests that species totals could be increased at most localities with further investigation. This also applies to Nonsuch, with several common species apparently overlooked and the water bugs (15 per cent of the total species in the London Area) not even attempted. The total for Mitcham Common was increased from 64 to 112 species (ten of which are water bugs) in a comprehensive survey by a team of entomologists working full-time for a year (1983–4). I have always considered Mitcham Common to be a prime site for insects, even after much of the natural habitat was destroyed by dumping, and the total for Nonsuch bears comparison with the total for Mitcham.

Groves classifies the frequency in the London Area of each species as abundant, common, frequent, occasional or rare. He recommends careful monitoring of the rare species, with special measures being considered for their safety if there is a likelihood of their habitat being altered in any way. Three species found in the current survey are classed as rare, but two of these can be discounted as they are becoming more common and their habitat is not threatened in any way.

Cyphostethus (*Elasmostethus*) *tristriatus* was formerly restricted to the declining juniper bushes of our chalk downlands, but in recent times it has colonized the related Lawson's cypress of our gardens and has become quite common. Another bug found on this tree at Nonsuch, *Orsillus depressus*, was not listed by Groves at all since it was only found in Britain for the first time in 1987. It is a Mediterranean species that has spread widely in Europe since adapting to this garden conifer, and is now spreading rapidly in south-east England.

The second 'rare' species is *Alloeotomus gothicus*, restricted to Scots pine, which was first discovered in Britain in 1951 at Oxshott. Outer Surrey is still its stronghold, but it is apparently still spreading slowly. The third 'rare' species, *Othocephalus coriaceus*, is one that I have not encountered before. Groves states that it is very local, and describes its habitat as rank grassy areas more especially where tansy, knapweeds, rest-harrow and bedstraws grow. At Nonsuch it was found in the north-east corner of Warren Farm, which appears to be the botanically-richest area.

No fewer than 28 of the 1993 species are classed by Groves as occasional as are a further four from the earlier list. These are

| | | |
|-----------------------------|----------------------------------|----------------------------------|
| <i>Legnotus limbosus</i> | <i>Tetraphleps bicuspis</i> | <i>Lygocoris viridis</i> |
| <i>Piezodorus lituratus</i> | <i>Deraeocoris olivaceus</i> | <i>Calocoris quadripunctatus</i> |
| <i>Eurydema oleracea</i> | <i>Amblytylus nasutus</i> | <i>Megacoelum infusum</i> |
| <i>Coreus marginatus</i> | <i>Psallus falleni</i> | <i>Megaloceraea recticornis</i> |
| <i>Rhopalus subrufus</i> | <i>Phoenicocoris obscurellus</i> | |
| <i>Chilacis typhae</i> | <i>Philophorus perplexus</i> | And from 1954–5 list |
| <i>Ischnodemus sabuleti</i> | <i>Orthocephalus saltator</i> | <i>Psallus diminutus</i> |
| <i>Stygnocoris rusticus</i> | <i>Orthotylus viridinervis</i> | <i>Orthotylus flavinervis</i> |
| <i>Gastrodes grossipes</i> | <i>Orthotylus prasinus</i> | <i>Charagochilus gyllenhali</i> |
| <i>Cymus melanocephalus</i> | <i>Orthops cervinus</i> | <i>Calocoris fulvomaculatus</i> |

Many of the above species are quite common in outer Surrey, and perhaps nationally. The only bug found at Nonsuch which is listed as nationally scarce is *Deraeocoris olivaceus*, yet another species first found in Britain quite recently, at Ascot in 1951, but which has spread only slowly. It inhabits large heavily-fruited hawthorn bushes, and several adult bugs were found in 1993 on the bushes beside the new pond.

The oak tree is well known for having most insects associated with it, and the woodland of Nonsuch Park, the Banqueting House and the fringes of Warren Farm yielded an almost complete sequence, through the seasons, of the bugs associated with oak. Many other bugs have restricted food plants. Birch (5 species found at Nonsuch), hawthorn (3), nettles (5), grass (9), Scots pine (3) and composite flowers (3) were the most productive, but other bugs were found that are restricted to larch, elm, lime and other broad-leaved trees, and to about a dozen different kinds of herbaceous plants.

Homopteran bugs

Only a few of the larger and more striking insects in this group were named. These included a local species of oak woodland, the eared leafhopper *Ledra aurita*, found at the Banqueting House in spring and also reported by Ian Menzies later in the year, and another local insect, the thorned treehopper *Centrotus cornutus*, also from the Banqueting House.

Hoverflies

Since several entomologists worked Nonsuch Park for hoverflies in 1993, the 32 species listed here need to be combined with the other records into a comprehensive list. Our records include the large and spectacular *Volucella inanis*, which is nationally scarce, but with its distribution centred on the London Area, and the equally handsome species of *Chrysotoxum*, three of which were seen, but only one was captured. Both British species of the brilliant yellow and black *Xanthogramma* are also present on Warren Farm, the second one being recorded by Peter Harvey. At the other end of the scale, the tiny black *Pipizella varipes* is widespread in Britain, but I had not met it before.

Butterflies and moths

These insects were only noted in passing, and the list of 13 butterflies and a few day-flying moths needs to be incorporated into a fuller list. However the purple hairstreak, flying around the oaks by the new pond, is a good find for the London Area, while the common blue added a touch of a different colour to the vast flowery expanses of Warren Farm. The nettle beds on the edge of

Warren Farm and Cherry Orchard Farm provide food for the caterpillars of colourful peacock and small tortoiseshell butterflies that will later adorn neighbouring gardens.

The day-flying moths included the pretty pink cinnabar, whose yellow and black banded caterpillars will help to control the abundant ragwort on Warren Farm, and the striking six-spot burnet. Two less-common species were also found, the burnet companion and the small yellow underwing, the latter a local species of flowery meadows throughout England and Wales.

Conclusions

Those areas of grassland which are regularly mown were almost devoid of life, but this is not to suggest that Nonsuch Park proper is a desert for wildlife — far from it. The mown grassland is dotted with mature trees of both native and exotic species, and most of these, especially the natives, support a rich and characteristic fauna. There are also fine mature hedges, and in places the trees are grouped into small areas of woodland. These are all excellent habitats for insects, and also for the birds, small mammals and other creatures that feed on the insects. The woodland is more extensive along the main road and the edge of Cheam Park, but this was not investigated this year. In the few areas where the grass and wild flowers have been permitted to grow long, perhaps being cut only annually or every few years, good populations of insects were present, even including local species. The new pond and its surrounding woodland was also found to be a very rich site.

The best of the adjoining areas was Warren Farm, which is at a very interesting stage at the moment. Farming has ceased and the fields have been allowed to revert to nature. The first flush of annual weeds has been replaced by a perennial flora which may seem monotonous at any particular spot but is rather diverse considering the farm as a whole. Although well used by walkers with and without dogs, the areas between the paths are largely undisturbed, giving ideal conditions for a great variety of insects to colonize and flourish. Left to itself, there will be a gradual but certain succession towards scrub and woodland, over a period of perhaps fifty years. The area would remain a rich habitat for wildlife of all kinds, although the species composition would change. Management could retard the succession to any desired stage. This farm has the makings of a prime wildlife site if this is intended. Some of the proposed alternative uses need not necessarily wholly destroy the wildlife interest. For instance a reversion to farming, preferably organic farming, might allow the wooded and bushy fringes to remain.

Similar considerations apply also to Cherry Orchard Farm, but here the insect fauna is rather different since the vegetation is extremely tall and rank, no doubt an effect of the type of farming formerly pursued on this site. The woodland and grassy field around the Banqueting House also seemed quite a good site, with several local species of insects found here.

The overall impression is of a great diversity of insect life, with few or no great rarities, but a good number of rather local species. Something apart from insect diversity struck me as a first-time visitor to Nonsuch. Firstly, the area is used very intensively by the public for walking dogs and many other activities. Secondly, the bird life is rich, especially at sites that are also good for insects. Finally, we were made aware of the depth of feeling in support for keeping the wild areas of Nonsuch undeveloped. We were frequently asked what we were doing with our strange apparatus, and the final statement of our new acquaintance was generally on the lines of 'Oh, I do hope that they manage to save it'.

An adaptation of butterfly transect monitoring to survey human park visitors

L. R. WILLIAMS

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Abstract

An attempt was made to adapt the well-established transect route method for monitoring butterflies to record human visitors to a park. Records of human visitors were made while monitoring butterflies on a transect at Fryent Country Park, Middlesex from 1988 to 1993. The results suggested that if butterfly monitoring was already undertaken, then the simultaneous collection of data on human visitors could provide an insight into the patterns of park use. However, the large number of variables which affected visitors and the difficulty of obtaining representative sample sizes, suggested that the method was not suitable for monitoring park visitors.

Introduction

The relative changes in abundance of many plant and animal groups can be estimated by monitoring in which the baseline survey work is repeated at regular intervals (Hellawell 1991, Usher 1991). One technique is the transect monitoring of butterflies (Hall 1981), and a national scheme to monitor the abundance of butterflies has been in operation since 1976 (Pollard, Hall and Bibby 1986). The method is based upon weekly counts at each site along a transect route as described by Pollard (1977). Butterfly monitoring is a long-term exercise since data over many years are required in order to analyse the effects of e.g. climate and site management. The national scheme involves monitoring at over 80 sites, many of which are nature reserves. A number of independent recorders use the same method and some collate data into regional networks. Two of the independent transects are at Fryent Country Park, Middlesex, where they are walked by local volunteers and by Brent Council. Fryent Country Park is a 100-hectare remnant of Middlesex countryside, now surrounded by the suburbia of north-west London and bisected by Fryent Way (Williams and Northcroft 1992). The Park is a Local Nature Reserve, owned and managed by Brent Council with considerable local community and volunteer input into the management of the Park's habitats. One of the transects commenced in 1986 and was described by Williams et al. (1991). To establish if the method could be adapted to monitor park visitors, the idea of simultaneously recording the number of human park visitors was attempted on one of the transects.

Methods

The shorter of the two Fryent Country Park butterfly transects was used for this investigation. It was 1.8 km in length and passed through the areas of young woodland with hedgerows in the south-east of the Park, with neighbouring fields managed as hay meadows and grassland (Figure 1). Footpaths of mown vegetation were located alongside each hedge and field edge, and across some of the fields. All of the transect route was on footpaths.

Butterfly monitoring has been described elsewhere, and simply, by Hall (1981), so only a brief summary is required in this paper. A transect route was walked once a week in the 26 weeks between the beginning of April and the end of September. Counts were made of the number of butterflies of each species seen on the route. For convenience the route was circular, so that a recorder could finish at the starting point. The transect was divided into sections based on different habitats. Only butterflies seen immediately in front of or at the side of the recorder were counted, and it was helpful to think in terms of walking along an imaginary corridor a few metres wide. Ideally, the same

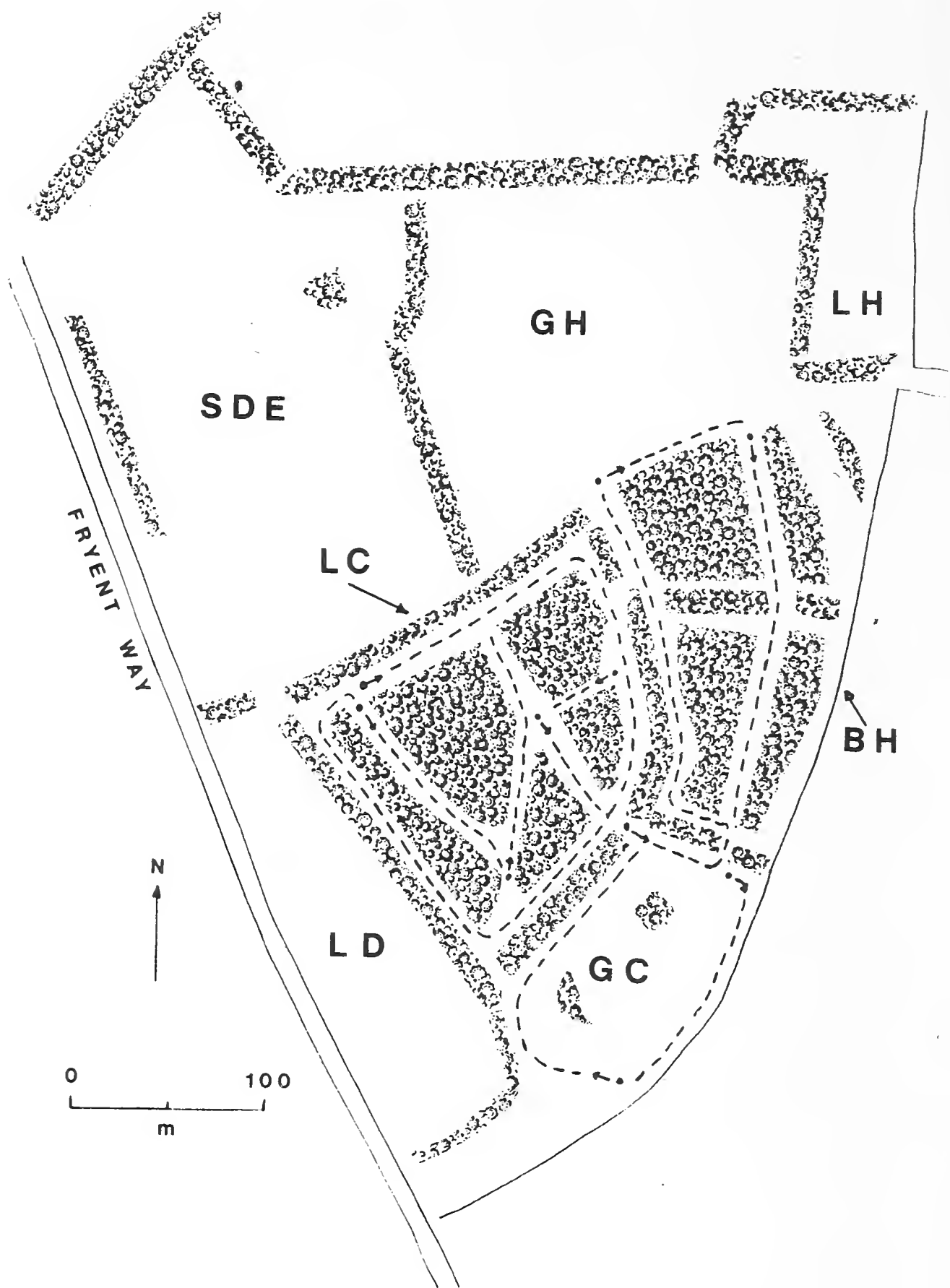


FIG. 1. The transect route (broken line) and the fields included in the visitor transect in the south-east of Fryent Country Park. SDE Short Down East, GH Great Hillcroach, LH Little Hillcroach, BH Beane Hill, GC Great Cowlays, LD Long Down, and LC Little Cowlays.

recorder walked the transect each week, though a team approach was usually more practical. If a week was missed due to poor weather or other reasons, the transect count for each butterfly species could be estimated by using the average of the two counts for the preceding and succeeding weeks. Generally the starting time for the transects was between 10.45 and 15.45 hours BST.

The weather conditions under which the counts were made were as uniform as possible and in conditions which were suitable for butterfly flight. Most flight occurs under warm, dry conditions, less frequently in cool, wet, overcast and windy weather.

Recording did not proceed at temperatures below 13°C. Between 13 and 17°C recording proceeded if there was at least 60 per cent sun (i.e., if it was sunny in at least 60 per cent of the sections). Above 17°C recording could proceed even in overcast conditions (0 per cent sun). Butterfly monitoring did not proceed if it was raining or when the wind speed was greater than 3 on the Beaufort scale. There is evidence that once these criteria are met, the counts of butterflies are strongly correlated with independent estimates of abundance, but scarcely at all with weather conditions during the counts (Pollard, Hall and Bibby 1986). Butterfly populations do however respond to weather conditions during the year, at each stage of their life cycles (Pollard 1988).

Since the number of human visitors passing the recorder along the transect route could be low, counts were made of all the people seen within defined limits in the Country Park, while walking the transect. This area, in the south-east of Fryent Country Park, is indicated in Figure 1. It encompassed the fields of Little Cowlays and Beane Hill (both of young broadleaved woodland), Great Cowlays (scrub); and four fields of hay meadow and grassland: Long Down, Short Down East, Great Hillcroach and Little Hillcroach (see Williams and Cunnington 1985). To the west the survey area was bounded by Fryent Way (the A4140), to the north by a continuation of Fryent Country Park, and to the east by the suburban housing and gardens of Salmon Street. The variables recorded on the butterfly transect were the date, butterfly week number, the time at which the transect commenced, wind speed on the Beaufort scale, the percentage of transects in the sun/shade, the temperature in the shade, the butterfly species and number of species seen, and the count of butterflies recorded. Much of this information could also be separated for each of the ten sections on the transect. The additional variables recorded for the human visitors were day of the week, the total number of people seen, the number of the visitors with and without dogs, and a subjective assessment by the recorder as to whether the footpaths were shoe or wellington boot walking country.

Results

This investigation was primarily concerned with establishing if butterfly monitoring could be adapted simultaneously to monitor human park visitors. The results obtained from Fryent Country Park illustrate the type of data that could be obtained and highlight the problems encountered in adapting the method. A total of 114 transects was walked, each of which was completed in approximately 45 minutes. A total of 502 human visitors was recorded. It was apparent however, that 94 of these visitors were participants in five organized events, represented by two cross-country runs and three guided walks. All of the guided walks were on Wednesdays after 14.00 hours and the cross-country runs were on Thursday afternoons. One of the runs, in April 1993, had 40 participants. Such organized events had a considerable effect upon the overall results, and since this would make interpretation more difficult it was decided to confine the analysis to casual park visitors, i.e. visitors who were not participating in pre-arranged events.

Of the 408 other visitors, 144 (35 per cent) were walking with dogs. Other activities included walking, family visits, picnics and horse riding. Visitors were analysed by year, month, day of the week, time of the day, whether it was considered wellington boot or shoe walking country, wind speed, the percentage sun and the temperature (Table 1). To standardize the variation in the number of transects walked at each time or under each condition, the counts of visitors were converted to the average number of visitors per transect and these were represented as a percentage of their sum.

The variation in the relative numbers of visitors per year are shown in Table 1. If these had been valid indices of human use, then they would have represented changes in the number of park visitors from year to year. However, these annual variations could not reliably be separated from the patterns suggested by the other variables recorded and presented in Table 1. Of the six months of the year during which transects were walked, April appeared to be the most popular month for both dog walkers and

TABLE 1. The relative numbers of visitors recorded on a transect at Fryent Country Park, 1988–1993, for identifiable variables. Results are presented as percentages of the sums of the average number of visitors per transect walked. Some rounding of percentages has been undertaken. Results are presented for dog walkers, non-dog walkers and for all visitors.

| Variables | Number of transects walked | Dog walkers % | Non-dog walkers % | All visitors % |
|-------------------------------|----------------------------------|------------------|-------------------------|-------------------|
| Year | | | | |
| 1988 | 22 | 17 | 12 | 14 |
| 1989 | 22 | 12 | 9 | 10 |
| 1990 | 19 | 18 | 27 | 24 |
| 1991 | 18 | 9 | 17 | 14 |
| 1992 | 16 | 26 | 16 | 19 |
| 1993 | 17 | 18 | 19 | 19 |
| | 114 | 100% | 100% | 100% |
| Month | | | | |
| April | 17 | 27 | 25 | 26 |
| May | 22 | 22 | 12 | 15 |
| June | 16 | 8 | 20 | 16 |
| July | 20 | 11 | 15 | 14 |
| August | 25 | 19 | 14 | 16 |
| September | 14 | 13 | 14 | 13 |
| | 114 | 100% | 100% | 100% |
| Day | | | | |
| Monday | 16 | 7 | 9 | 8 |
| Tuesday | 11 | 16 | 5 | 9 |
| Wednesday | 14 | 17 | 8 | 11 |
| Thursday | 9 | 13 | 16 | 15 |
| Friday | 4 | 14 | 14 | 15 |
| Saturday | 32 | 13 | 17 | 15 |
| Sunday | 28 | 20 | 31 | 27 |
| | 114 | 100% | 100% | 100% |
| Start time (BST) | | | | |
| to 11.44 hours | 18 | 25 | 16 | 19 |
| 11.45–12.44 | 22 | 16 | 17 | 17 |
| 12.45–13.44 | 14 | 10 | 22 | 18 |
| 13.45–14.44 | 36 | 18 | 19 | 19 |
| 14.45–15.44 | 24 | 31 | 26 | 27 |
| | 144 | 100% | 100% | 100% |
| Walking country type | | | | |
| Wellington boot | 9 | 66 | 54 | 59 |
| Shoe | 105 | 34 | 46 | 41 |
| | 114 | 100% | 100% | 100% |
| Wind speed: Beaufort scale | | | | |
| 0 | 5 | 28 | 31 | 31 |
| 1 | 33 | 18 | 26 | 23 |
| 2 | 45 | 34 | 21 | 25 |
| 3 | 31 | 20 | 22 | 21 |
| | 114 | 100% | 100% | 100% |

| Variables | Number of transects walked | Dog walkers % | Non-dog walkers % | All visitors % |
|----------------|----------------------------|------------------|----------------------|-------------------|
| Percentage sun | | | | |
| 0–20 | 12 | 7 | 12 | 11 |
| 21–40 | 13 | 35 | 19 | 24 |
| 41–60 | 9 | 22 | 26 | 25 |
| 61–80 | 14 | 14 | 25 | 21 |
| 81–100 | 66 | 22 | 18 | 19 |
| | 114 | 100% | 100% | 100% |
| Temperature°C | | | | |
| 12–15°C | 10 | 40 | 32 | 35 |
| 16–19°C | 41 | 28 | 28 | 28 |
| 20–23°C | 46 | 21 | 21 | 21 |
| 24–27°C | 17 | 11 | 19 | 16 |
| | 114 | 100% | 100% | 100% |

other visitors. While walking the transects it was noted that the vegetation on the paths would be relatively short in April, but that in some years cutting was not undertaken during the spring and the long vegetation may have deterred some visitors. Sundays were the most popular day for both dog walkers and other visitors. Saturdays did not appear to be busier than some weekdays. Dog walkers were more evenly spread by day of the week than other visitors. Transects were walked at various start times from 10.45 to 15.45 hours, with the highest number of visitors recorded after 14.45 hours. For dog walkers there was a smaller peak in the mornings on transects starting before 11.45 hours. The data on the state of the ground as between wellington boot and shoe walking country were limited by the small number of transects (9) which were walked under the former condition. Transects were walked in only a limited range of wind speeds, and these did not appear to affect visitors. There was some evidence that visitors avoided overcast weather (0 – 20 per cent), but appeared to be indifferent to the sun between 21 – 100 per cent. Temperature affected both dog walkers and other visitors. The number of visitors declined as temperatures rose from 12–15°C to 24–27°C and this was especially marked for dog walkers.

Discussion

The analysis presented in the results suggested that the simultaneous use of butterfly transect monitoring to record human park visitors had more use in establishing the pattern of park use than in monitoring the extent of that use. The numbers of park visitors appeared to be affected by the year, month, day of the week, time of the day and by the temperature. Dog walkers differed from other visitors in presumably having to walk their dogs each day of the week, preferably twice a day and in avoiding temperatures which would be uncomfortable to an exercising dog. With hindsight it was considered that other data should have been collected, especially on the height of the vegetation on footpaths, since high vegetation was a deterrent to many walkers. Account could have been taken of bank holidays, school holidays and other categories of park user, for example, horse riders. The effect of organized guided walks and cross-country runs on the data had not been envisaged at the outset and these events were excluded from the main analysis. Sample sizes were often very small, even out of a total of 114 transects. Furthermore, the transect was walked in a relatively under-used area of the Country Park and was only walked for a fraction of each week representing about one per cent of daylight hours. The butterfly transect method effectively excluded recording between October and March, between 15.45 and 10.45 hours, and in cold, overcast, windy or wet weather conditions. Crucially, the transect method for monitoring adult butterflies had been devised for that particular purpose and the transects walked under standardized conditions. Such conditions were too restrictive

for the much wider range of conditions in which humans may visit an area of countryside. And whilst butterfly indices represent estimates of the relative butterfly abundance from one year to another, for sedentary species such as humans, the records would represent the level of park use rather than a population estimate. The treatment of the results from butterfly monitoring involves the calculation of indices for each species, which may include estimates for weeks when the transect was not walked. The calculation of indices for monitoring park users was not practical with the data available.

Whilst some of these problems could be addressed by using a larger sample size and by walking transects under a wider range of conditions, conventional survey methods may be more appropriate if monitoring park visitors is the primary aim of an investigation. Questionnaire-based surveys are used by some local authorities (e.g. Locke 1985), the Countryside Commission and agencies represented on the Countryside Recreation Network. Such questionnaires often aim to obtain information about visitor satisfaction, as much as information about patterns of park use, for example those organized by Brent Council. Rowley (1992) described a study of the use made of a sample of small open spaces in central London and referred to publications from abroad. Recent publications have emphasized the importance of wildlife sites to people, especially those living locally. Mostyn (1979) discussed the personal benefits from participation in urban wildlife projects, and Johnston (1990) reviewed the establishment, management and use of nature areas in London. The use of nature areas by people should not be ignored when assessing the wildlife value of those sites. Simple methods for surveying the pattern of human visits may be effective for assessing the use of nature areas.

Acknowledgements

Antony Kwissa and David Brown of Barn Hill Conservation Group walked the longer butterfly transect, while Judith Stuart collated some of the data for the park visitor transect. Shaun Faulkner, parks manager, and Elvis Johnson-Idan of Brent Council provided assistance with the work of the investigation.

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Further records of terrestrial mites from Buckingham Palace Garden

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Summary

Seventy species of terrestrial mites are listed and of these, seven Mesostigmata are additional to the 27 named by Bristowe (1964). The remainder belong to the orders Cryptostigmata (26 species), Astigmata (3) and Prostigmata (12). The taxa given tentative identifications are likely to be referable to additional species. One species, *Zygoribatula frisiae* (Oudemans), is little known from the British Isles, the remainder are widespread.

Introduction

From 1960 to 1963 a team of around thirty naturalists led by Dr W. S. Bristowe, D. McClintock, Maxwell Knight and Professor O. W. Richards conducted a survey of the natural history of the garden of Buckingham Palace. The results were published by the South London Entomological and Natural History Society (1964) as a special issue of its *Transactions*. The section on non-insectan invertebrates was co-ordinated by Bristowe (1964), and his report listed 27 species of mesostigmatic mites collected and identified by Dr G. O. Evans of the British Museum (Natural History). All were relatively common species that occur in a variety of terrestrial habitats. Meanwhile, another member of the team, Mr P. N. Lawrence from the Museum's Department of Entomology, amassed a large collection of terrestrial mites from soil and litter samples during the course of his quest for Collembola (Lawrence 1964). It is this material which forms the basis of the present records. The identifications, some of which remain tentative, were made by Mr D. C. Lee, formerly of Rothamsted Experimental Station and now at the South Australian Museum, Adelaide. All this material, together with further unexamined samples from the survey, is stored in the Arachnida Section of the Museum.

The collection

The material enumerated here, and collected by Mr Lawrence, originates from eight sampling sites. Most of the species are found in a variety of terrestrial habitats, though one, *Hydrozetes lacustris* (Michael), lives solely in fresh water, being found here in the wet sample 1650 with several other species adapted morphologically to subaquatic conditions.

In the following list, only in the Mesostigmata are the sexes of adults shown, as in this order they are readily discernible, even at a low magnification, whereas in the other orders, the sex is not always apparent. Where immature developmental stages are shown, they are as follows: PN – protonymph, DN – deutonymph, TN – tritonymph, N – nymph (instar not apparent).

* indicates Mesostigmata recorded in the 1964 report.

Samples

1641 – carpet of moss under holly (between grass and bare ground)

1643 – dry litter on bare ground under holly

1645 – long coarse grass on slope

1650 – wet humus between rhizomes at extreme margin of lake

1653 – litter under rose-bush near flamingos' hut

1659 – humus against fence bordering lake

1662 – manure heap

Stn 1 – song thrush nest

ORDER MESOSTIGMATA

Family Macrochelidae

**Geholaspis (Geholaspis) longispinosus* (Kramer) 1♀ 1645.

**Geholaspis (Longicheles) mandibularis* (Berlese) 3♀♀ 1653.

Family Eviphididae

**Alliphis halleri* (G. & R. Canestrini) 1♂ 1653.

Family Phytoseiidae

Amblyseius sp(p). 1♀ 1643, 1♀ 1653

Family Ameroseiidae

**Ameroseius echinatus* (C. L. Koch) 2♀♀, 3LL 1645, 1♀ 1653.

**Epicriopsis horridus* (Kramer) 2♀♀ 1653.

Family Ascidae

**Cheiroseius necorniger* (Oudemans) 2DNN, 4♂♂, 4♀♀ 1650.

**Cheiroseius serratus* (Halbert) 1♀ 1650.

**Gamasellodes bicolor* (Berlese) 28 1641, 19 1643, present 1645.

**Platyseius italicus* (Berlese) 14♀♀ 1650.

**Platyseius subglaber* (Oudemans) 1♂, 2♀♀ 1650.

**Zercoseius spathuliger* (Leonardi) 1♀ 1641.

Family Laelapidae

**Cosmolaelaps claviger* (Berlese) 1♂ 1641, 1♀ 1650.

**Hypoaspis aculeifer* (G. Canestrini) 3♀♀ 1641, 3♀♀ 1645, 1♀ 1659.

Pseudoparasitus sp. 1♀ 1645.

Laelapidae indet. 2DNN 1641.

Family Rhodacaridae

**Rhodacarus roseus* Oudemans 1DN, 3♀♀ 1641, 1♀ 1643, 1DN, 2♂♂, 2♀♀ 1645, 21 1653.

Family Digamasellidae

Digamasellus sp. present 1645, 2♀♀ 1653, 1♀ 1659.

Family Veigaiidae

**Veigaia nemorensis* (C. L. Koch) 1PN, 1DN, 1♀ 1645.

**Veigaia planicola* (Berlese) 1♀ 1643, 1♀ 1645, 4DNN, 4♀♀ 1653.

Family Parasitidae

**Cornigamasus lunaris* (Berlese) (= *Parasitus lunulatus* (Müller)) 1♀ 1643, 1♀ 1659.

**Paragamasus runciger* (Berlese) 1♀ 1641, 1♀ 1643, 2♀♀ 1645, 4♀♀ 1653.

**Parasitus loricatus* (Wankel) 1DN, 1♂ 1662.

**Pergamasus longicornis* (Berlese) many ♂♂, ♀♀ 1643, 3DNN, 2♂♂, 2♀♀ 1645.

Pergamasus septentrionalis (Oudemans) 1♂ 1♀ 1643, 1♂ 1653.

Parasitidae indet. 4DNN 1641.

Family Zerconidae

**Prozercon traegardhi* (Halbert) 2♂♂ 3♀♀ 1653.

Family Uropodidae

?*Cilliba* sp. 1♀ 1650, 1♀ 1659.

Olodiscus minima (Kramer) 13♀♀ 1643, 1DN, 6♀♀ 1645, 4♀♀ 1650, 2DNN, 54♀♀ 1653.

Dinychura sp. 1DN, 1♀ 1643, 2PNN, 1♀ 1645, 2DNN, 6♂♂, 3♀♀ 1653, 1♂ 1662.

Dinychus sp. 1♀ 1645.

ORDER CRYPTOSTIGMATA

Family Euphthiracaridae

Rhysotritia sp. 2 1645, 8 1653.

Family Phthiracaridae

Phthiracarus sp. 1 1645, 1 1659.

Family Hypochthoniidae*Hypochthonius rufulus* C. L. Koch 1 **1643**.*Hypochthonius* sp. 6 **1659**.**Family Hermannidae***Hermannia ?scabra* (L. Koch) 8 adults, 150+ immatures **1641**, 4 **1645**.*Hermannia* sp. 33 adults, 100+ immatures **1643**, 23NN **1645**.**Family Hydrozetidae***Hydrozetes lacustris* (Michael) 1 **1650**.**Family Damaeidae***Damaeus* sp. 4 **1645**, 1 **1662**.**Family Tectocephidae***Tectocephus velatus* (Michael) 51 **1641**, 6 **1645**, 2 **1650**.*Tectocephus* sp. 8 **1643**, 3 **1653**.**Family Oppiidae***Oppia* sp. 1 **1641**, 8 **1643**, 69 **1645**, 4 **1650**, 21 **1653**, 52NN **1659**.**Family Ceratozetidae***Ceratozetes* sp. 2 **1645**.*Fuscozetes* sp. 1 **1641***Sphaerozetes* sp. 1 **1650**, 1 **1662**.*Trichoribates trimaculatus* (C. L. Koch) 1 **1643**.**Family Euzetidae***Euzetes globulus* (Nicolet) 4 **1645**, 3 **1653**, 5, 1TN **1659**.**Family Mycobatidae***Minunthozetes semirufus* (C. L. Koch) 2 **1641**, 3 **1643**, 36 **1645**, 1 **1650**, 10 **1653**.*Punctoribates punctum* (C. L. Koch) 2 **1641**, 5 **1643**, 2 **1645**, 1 **1650**, 13 **1653**, 3 **1659**.**Family Galumnidae***Acrogalumna longipluma* (Berlese) 1 **1659**.**Family Oribatellidae***Oribatella calcarata* (C. L. Koch) 1 **1643**.**Family Oribatulidae***Liebstadia similis* (Michael) 27 **Stn 1**.*Zygoribatula frisiae* (Oudemans) 1 **1643**. This European species has a limited southern distribution in the British Isles, being recorded only from Bedfordshire and Norfolk (Luxton 1990), and the Isles of Scilly (Hyatt 1993).**Family Scheloribatidae***Scheloribates latipes* (C. L. Koch) or *laevigatus* (C. L. Koch) 45 **1645**.*Scheloribates* sp. 2 **1641**, 12 **1643**, 59 **1653**.**Family Scutoverticidae***Scutovertex sculptus* Michael 1 **1643**, 1 **1645**.**Family Phenopelopidae***Pelops tardus* (C. L. Koch) 1 **1643**.**ORDER ASTIGMATA****Family Acaridae***Monieziella corticalis* (Michael) 6 **Stn 1**.*Schwiebia talpa* Oudemans 18 **1645**.*Tyrophagus dimidiatus* (Herman) 46 **1641**, 34 **1643**, 11 **1645**, 4 **1650**, 3 **1659**, 1 **Stn 1**.

ORDER PROSTIGMATA

Family Pyemotidae*Pygmephorus blumentritti* Krczal 1 1641.*Pygmephorus* sp. nr *decumanus* Krczal 1 1653.**Family Pachygnathidae***Pachygnathus villosus* Dugès 1 1645.**Family Nanorchestidae***Nanorchestes* sp. 7 1641.**Family Rhagidiidae***Coccorhagidia* sp. 4 1653.**Family Tydeidae***Tydeus* sp. 5 1641, 4 1643, 2NN 1645, 1 1650, 1 Stn 1.**Family Eupodidae***Cocceupodes* sp. 2 1653*Eupodes* sp. 4 1653.*Linopodes ?motatorius* (Linnaeus) 3 1645.*Linopodes* sp. 1 1662.

Eupodidae indet. 1L, 1N 1645.

Family Tetranychidae*Eotetranychus carpini* (Oudemans) 1 1645.**Family Erynetidae***Erynetes sittardiensis* Oudemans 4 1641, 3 1643, 1 1645.**Acknowledgement**

I would like to thank Mr D. C. Lee for permission to publish his identifications.

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Spiders and disturbance — 2

A study on West Heath, Hampstead

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Introduction

This study is a continuation of the survey of a number of grassland sites on the main part of Hampstead Heath from May 1991 to May 1992 (Milner 1993).

The new area for study was chosen as a few heather *Calluna vulgaris* plants, relics of earlier vegetation of the area, had been noted in a little-frequented part of West Heath. It was thought that this relatively undisturbed (but unfenced) site could also contain unusual spiders. A twelve-month survey using pitfall traps was started in May 1993. The traps were emptied at approximately monthly intervals throughout the twelve months.

In addition a certain amount of sweep-netting was done in the same area on nearby bushes (mainly gorse), lower branches of trees and on tall herbs and grasses on the occasions when the vegetation was dry.

Two objectives were identified: (1) as the heather was a relic of the earlier flora it was hoped that there might also be some relics of the associated spider fauna (including even species known to have occurred on the Heath in former times), and (2) as the survey method matched the earlier investigation precisely some comparison could be made with the other sites on the main Heath already reported. These sites had differed in spider fauna greatly depending on the amount of disturbance; as the West Heath site was relatively little disturbed, and unmown, the spider catch was expected to resemble the catch inside the bird sanctuary (03 in the earlier study), the only relatively undisturbed grassland site among the places previously sampled.

The West Heath site

The place where the *Calluna vulgaris* plants grow in the dense grass sward is an open area only about 20 m × 30 m just north of West Heath Road near Branch Hill. The area is surrounded by young oak and birch trees not more than about twenty years old, and there are also some mature gorse bushes close by, some of them of probably greater age than the trees.

The grass sward is dense, uneven and tussocky with some moss and a number of occupied anthills. It is dominated by *Festuca rubra* and *Poa pratensis*, with patches of *Deschampsia flexuosa* and a good deal of sheep's sorrel *Rumex acetosella*. Towards the road there is a good deal of the larger grasses *Arrhenatherum elatius* and *Alopecurus pratensis* and clumps of the vigorous *Dactylis glomerata*. There is visible evidence of rabbits in the area, and on more than one occasion rabbits were seen nearby.

During the period of study some young oak trees that had been shading the heather were removed by the managers of the Heath, but the area, although open to public access, is relatively undisturbed.

Materials and methods

Traps were set in standard trios (Milner 1993): trio 012 in the grass sward three metres from the nearest gorse/oak shade, and trio 013 in the grass under the edge of the gorse bushes. A single trap (014) was set for several months under the largest group of

heather plants and another single trap (015) was set for some time adjacent to a large anthill. The traps were operational from May 1993 to May 1994.

Sweep-netting of the surrounding bushes was done in May and June.

Results

1. Pitfall trapping

The main results of the trapping are given in Table 1. Totals of 265 (24 spp.) and 258 (32 spp.) were taken at the two trap sites 012 and 013 respectively. The aggregate for the two sites was 40 species. One further species was added from the single trap (014) set under the clump of heather, and a 12 further species were taken by sweep-netting. Two species had already been recorded from the site, but were not found again during this study. In total 55 species have now been recorded for West Heath, and one parasite, but this is obviously a considerable underestimate for West Heath as a whole. A complete list for the site is given in the Appendix.

TABLE 1. Main catch — 50% and 75% refer to the number of species making up the first 50 and 75% of the total catch. × = proportion of total catch made up of seven 'weed' species (see also Table 3).

| Site | Nos | Spp. | 50% | 75% | × |
|-------------------------------|-----|------|-----|-----|-------|
| 012 Dense sward, open | 265 | 24 | 3 | 6 | 13.2% |
| 013 Gorse edge, partly shaded | 258 | 31 | 4 | 11 | 3.2% |
| Total | 523 | 41 | | | |

The trapping produced very low 12-month catches for such a site. The very unusual weather conditions during much of the study period must be a partial explanation for this. The autumn and winter of 1993–4 was an exceptionally wet and cold period and this probably affected spider numbers considerably. Table 2 shows some rainfall records for the study period obtained from the London Weather Centre. The writer is also engaged in monitoring spiders over a longer period in Queen's Wood and the totals for the same 12-month period there were around 30–40 per cent below the average. However the figures are even lower than would be expected and remain something of an anomaly.

TABLE 2. Rainfall during some of the trapping period.

| Month | Percentage of normal monthly rainfall |
|----------------|---------------------------------------|
| August 1993 | 50 |
| September 1993 | 165 |
| October 1993 | 210 |
| November 1993 | 58 (snow and frost) |
| December 1993 | 140 |
| January 1994 | 156 |
| February 1994 | 112 |

The diversity at each site was rather low, probably related to the low total catch. However the aggregate for the two sites (only about four metres apart) of 40 species was more satisfactory. Unfortunately no particularly unusual or rare spiders were found and some of the species in the list were more typical of woodland than grassland habitats (such as *Monocephalus fuscipes*, *Microneta viaria*, and *Centromerus dilutus*).

However when the actual species list is examined, it can be seen that the main catch was dominated by characteristic grassland spiders with wolf spiders (Lycosidae) and

the grassland tetragnathid *Pachygnatha degeeri* together making up 50 per cent and 45 per cent of the catch at the two sites (Table 3). The so-called ‘weed’ species such as *Oedothorax* spp., *Erigone atra*, and *E. dentipalpis*, which are the dominant species in the grass over most of the public parts of the Heath, were conspicuous by their absence.

TABLE 3. Scores for 12-month trapping at West Heath and other London grassland sites for eleven common species.

Site nos 03 and 10 refer to sites in the earlier Hampstead Heath study; Open is a site on acid grassland at Barnes Common (Milner 1993); Heath is from an earlier study of Alexandra Park (Milner 1987); Lawn is from the writer’s garden in Crouch End.

| Sites | 012 | 013 | Open | 03 | Heath | 10 | Lawn |
|---------------------------------|------|------|------|-----|-------|-----|------|
| Estimated level of disturbance* | ?2–3 | ?2–3 | 1–2 | 2 | 3 | 4–5 | 5+ |
| ‘Weed’ species | | | | | | | |
| 1. <i>O. fuscus</i> | – | – | – | 1 | – | 191 | 398 |
| 2. <i>B. gracilis</i> | 4 | 3 | 1 | 6 | 47 | 276 | 6 |
| 3. <i>E. dentipalpis</i> | – | – | 2 | – | 7 | 115 | 189 |
| 4. <i>L. tenuis</i> | 26 | 4 | 3 | 12 | 69 | 103 | 14 |
| 5. <i>O. retusus</i> | – | – | – | – | – | 52 | – |
| 6. <i>E. atra</i> | – | – | 2 | 3 | 2 | 95 | 38 |
| 7. <i>T. vagans</i> | 4 | – | 2 | 1 | 69 | 65 | – |
| Total for 7 ‘weeds’ | 34 | 7 | 10 | 23 | 194 | 897 | 645 |
| Percentage of catch | 12.8 | 2.7 | 2.1 | 4.3 | 16.9 | 84 | 95 |
| Grassland species | | | | | | | |
| 8. <i>P. pullata</i> | 38 | 60 | 125 | 137 | 154 | 4 | 1 |
| 9. <i>P. degeeri</i> | 70 | 8 | 2 | 1 | 373 | 13 | 5 |
| 10. <i>T. terricola</i> | 21 | 39 | 7 | 12 | 10 | – | – |
| 11. <i>A. pulverulenta</i> | 3 | 9 | 62 | – | 195 | – | – |
| Total grassland spp. | 132 | 116 | 196 | 150 | 732 | 17 | 6 |
| Percentage of total | 50 | 45 | 42 | 28 | 64 | 1.7 | 0.9 |
| Total catch | 265 | 258 | 471 | 558 | 1,143 | 995 | 681 |
| No. of species | 24 | 31 | 44 | 43 | 34 | 29 | 18 |

Species 1–7 are ‘weed’ species common in disturbed habitats; species 8–10 are some of the most abundant of the typical grassland species in the London Area.

*Estimated disturbance is rated, subjectively, from 0 (completely undisturbed) to 5 (highly disturbed).

Simple diversity counts (numbers of species making up 50 per cent and 75 per cent) are similar to those already obtained at other sites on Hampstead Heath, although the score of 11 at 75 per cent for site 013 is excellent and unusually high. The dominance of typical grassland species and absence of ‘weeds’ meant that the catch was unlike those at all the earlier grassland sites except 03, which was inside the fenced Bird Sanctuary.

It is possible that the bad weather accounted in part for the low diversities at the two sites sampled, especially for site 012 where it must be assumed that 8–10 additional species may normally occur, including linyphiids like *Centromerita concinna* and *Bathypantes parvulus* which were taken at site 013. Wet weather probably favours the large strong species such as the lycosids, at the expense of the smaller linyphiids. These latter depend on small interstices between the stems of the grasses and near the surface of the soil for places to live; in very wet conditions these places may be compressed. Very small species such as *Lepthyphantes insignis* or *Tapinocyba praecox*, both known

from elsewhere on the Heath, and which could be expected to be seen in a drier year, were not taken. Others including *Xysticus cristatus* (Thomisidae), and *Enoplognatha thoracica* (Theridiidae) and smaller species such as the linyphiids *Dicymbium brevisetosum* (which was however taken at trap 015) and *Meioneta rurestris* (recorded previously from the site, but not taken in the traps), would normally be expected to occur in traps at such a site. The presence of anthills in such sites in the London Area normally also seems to attract *Zelotes latreillei* (Gnaphosidae) but this has yet to be taken on West Heath. The ant-mimic *Phrurolithus festivus* was taken at site 012.

2. Sweep-netting

Twelve additional species not found in the pitfalls were taken, but none of these were large orb-web-spinning spiders. Even *Araneus diadematus* (Araneidae), the common garden spider, was not seen, and nor was *Araneus quadratus*, although both are known to occur elsewhere on the Heath.

Discussion

The remaining heather is now such a tiny patch that unfortunately there is apparently no community of heathland species such as *Episinus angulatus*, unlike some places in the London Area with relic heather patches like Bostall Heath in south-east London.

However the results suggest that the area does have a healthy and reasonably diverse spider fauna for an area of semi-natural grassland in London, especially one with low to intermediate levels of disturbance.

Comparison with other grassland sites in London

From Table 3 a clear separation of disturbed and undisturbed grassland sites is evident. The seven 'weed' species as a proportion of the total annual catch is spectacularly different. For the four less-disturbed sites, including 012 and 013 the range of 'weed' occurrence is from 2.1 per cent to 12.6 per cent of the total catch, while for the two disturbed sites given, (10 and Lawn) 'weed' catch ranges from 84 per cent to 95 per cent.

Furthermore, aggregates of four of the most typical grassland species are counted (three lycosids plus *Pachygnatha degeeri*), the percentages are similarly spectacular. The less-disturbed sites (including the two from this study) ranged from 28 per cent to 64 per cent, while the highly disturbed sites scarcely have any of these species at all: totals for these species making up just 0.9 per cent and 1.7 per cent of the catch at sites 10 and Lawn.

In Figure 1 the catch of 'weeds' is plotted against the group of grassland spiders for a number of grassland sites in London where 12-month trapping has been done. The sites can be seen to separate into two very different groups depending on which of these groups dominates. In future data from more intermediate sites will be sought.

The West Heath site

Even with the limited results of this study, it seems that the area has considerable potential for spiders and therefore probably for other grassland invertebrates. The lack of mowing (due in part to inaccessibility) is probably an important element of the low disturbance, but the area is also not as heavily trampled as most other parts of the Heath, and the presence of rabbits suggests that fewer dogs visit this area than others.

However, the area is slowly diminishing in size as surrounding trees have encroached, and these could certainly be cut back further before the area becomes overshadowed. The existence of several inhabited anthills in the area is important; there are few places on the Heath where they have survived. As one might expect, the presence of heather is just one of a number of features which indicated low disturbance both now and historically. Unfortunately, on the evidence of this survey, there does not appear to be extant a relict spider fauna.

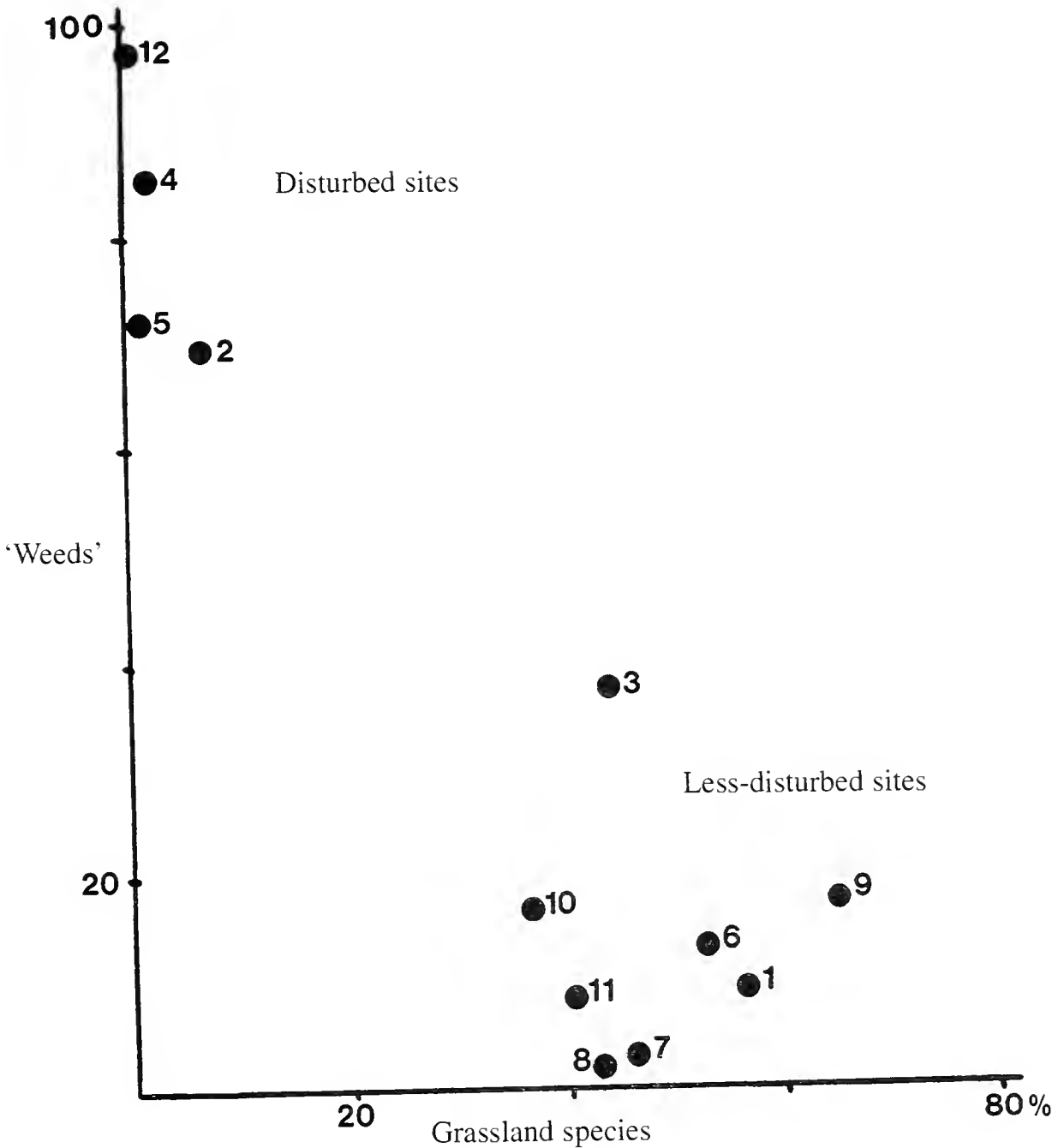


FIG. 1. Twelve-month spider catches from grasslands in London: seven 'weeds' as a percentage of catch plotted against four typical grassland species. (See Table 3 for list of species in each group).

- | | |
|--|--------|
| 1 = Hampstead Heath site 03 (inside Bird Sanctuary) | 1992-3 |
| 2 = Hampstead Heath site 05 (Lower Coyne's Field) | 1992-3 |
| 3 = Hampstead Heath site 08 (South Heath) | 1992-3 |
| 4 = Hampstead Heath site 10 (Kite Hill) | 1992-3 |
| 5 = Hampstead Heath site 11 (South Heath) | 1992-3 |
| 6 = Hampstead Heath site 12 (West Heath) (this study) | 1993-4 |
| 7 = Hampstead Heath site 13 (West Heath) (this study) | 1993-4 |
| 8 = Barnes Common 'Open' site | 1990-1 |
| 9 = Alexandra Park 'Heath' site | 1985-6 |
| 10 = Alexandra Park 'Tussock' site | 1985-6 |
| 11 = Mutton Brook (London Borough of Barnet) grassland site* | 1990-1 |
| 12 = Crouch End lawn | 1986-7 |

* At Mutton Brook, *Pardosa prativaga*, a closely-related species, was included with *P. pullata* as it was equally abundant. At the other sites it was absent or occurred in very small numbers.

Management implications

The area should be kept as it is, with the dense grass sward which includes the heather disturbed as little as possible, possibly even fenced off. Two trends should be resisted: (1) the encroachment of the secondary woodland, especially by the establishment of

oak and birch seedlings. The presence of the rabbits is probably contributing positively to this, but some years ago (possibly when the rabbit population was lower due to myxomatosis), a number of oaks and birches did become established. Some of these small trees could now be discouraged and cut back or even removed completely.

(2) the fertilizing effect along the side of the nearby road. This should be monitored, and the rank grasses perhaps cut by hand *and the cuttings removed*. The purpose of this would be to remove excess nutrients which are clearly having a damaging effect on some of the roadside vegetation at present. Without this attention, the coarser vigorous grasses such as *Dactylis glomerata* will probably continue to encroach on the nutrient-poor community a little further from the road, and this will inevitably affect the ecology of the area.

One feature of the Heath in former times was the presence of some other spiders, including the large spectacular *Araneus marmoreus*. This is a large brown orb-web spider with a characteristic yellow mark running down the mid-line of the abdomen. In any plans to reintroduce this species to the Heath, the study area on West Heath could be a possible site. There are numerous dense stands of gorse with bramble, etc., and the level of disturbance, already low, could probably be reduced still further with a limited amount of fencing. A reintroduction plan for the area is urged on the authorities, perhaps starting with *A. diadematus* and *A. quadratus* specimens from elsewhere, and if successful followed with *A. marmoreus*.

Acknowledgements

I wish to thank the Corporation of London and the Management of Hampstead Heath for their support in commissioning this work. I would also like to thank David Bevan for identifying the grasses, and the London Weather Centre for the information about rainfall.

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APPENDIX

Complete list of species recorded for West Heath, Hampstead Heath. Figures are for the traps for the 12-month period.

* = present, S = swept from bushes, P = previously recorded from the site, but not found during this study. Ad = one specimen parasitized by a larva of the ichneumonid *Acrodactyla degener*.

| | Trapping site | | | | |
|-------------------------------|---------------|-----|-----|-----|--------|
| | 012 | 013 | 014 | 015 | Bushes |
| DICTYNIDAE | | | | | |
| <i>Dictyna uncinata</i> | | | | | S |
| CLUBIONIDAE | | | | | |
| <i>Clubiona terrestris</i> | | | | | S |
| <i>Clubiona lutescens</i> | | | | | S |
| LIOCRANIDAE | | | | | |
| <i>Phrurolithus festivus</i> | 1 | | | | |
| PHILODROMIDAE | | | | | |
| <i>Philodromus dispar</i> | | | | | S |
| <i>Philodromus cespitum</i> | | | | | S |
| LYCOSIDAE | | | | | |
| <i>Pardosa pullata</i> | 38 | 60 | | | |
| <i>Alopecosa pulverulenta</i> | 3 | 9 | | | |
| <i>Trochosa ruricola</i> | 12 | 3 | | | |

| | Trapping site | | | | Bushes |
|------------------------------------|---------------|-----|-----|-----|--------|
| | 012 | 013 | 014 | 015 | |
| <i>Trochosa terricola</i> | 21 | 39 | * | | |
| MIMETIDAE | | | | | |
| <i>Ero furcata</i> | | 1 | | | |
| THERIDIIDAE | | | | | |
| <i>Anelosimus vittatus</i> | | | | | S |
| <i>Theridion sisyphium</i> | | | | | S |
| <i>Theridion tinctum</i> | | 1 | | | |
| <i>Theridion bimaculatum</i> | | 2 | | | |
| <i>Enoplognatha ovata</i> | | | | | S |
| <i>Robertus lividus</i> | | 2 | * | * | |
| TETRAGNATHIDAE | | | | | |
| <i>Tetragnatha</i> sp. (immatures) | | | | | S |
| <i>Pachygnatha clercki</i> | | 1 | | * | |
| <i>Pachygnatha degeeri</i> | 70 | 8 | * | | |
| METIDAE | | | | | |
| <i>Metellina mendei</i> | | | | | S |
| ARANEIDAE | | | | | |
| <i>Araniella cucurbitina</i> | | | | | S |
| LINYPHIIDAE | | | | | |
| <i>Walckenaeria acuminata</i> | 5 | 7 | * | | |
| <i>Walckenaeria antica</i> | 2 | | | | |
| <i>Walckenaeria cucullata</i> | | 3 | | | |
| <i>Dicymbium brevisetosum</i> | | | | * | |
| <i>Gongylidium rufipes</i> | | 2 | | | |
| <i>Maso sundevalli</i> | | | | | S |
| <i>Pocadicnemis juncea</i> | 2 | | | * | |
| <i>Tiso vagans</i> | 4 | | | | |
| <i>Monocephalus fuscipes</i> | | 4 | | | |
| <i>Gongylidiellum vivum</i> | 2 | | | | |
| <i>Micrargus herbigradus</i> | 10 | 18 | * | * | |
| <i>Micrargus subaequalis</i> | 1 | | | | |
| <i>Meioneta rurestris</i> | P | | | | |
| <i>Meioneta saxatilis</i> | | 1 | | | |
| <i>Microneta viaria</i> | | 4 | | | |
| <i>Centromerus sylvaticus</i> | 6 | 7 | * | * | |
| <i>Centromerus dilutus</i> | | 1 | | | |
| <i>Centromerita bicolor</i> | 2 | | * | | |
| <i>Centromerita concinna</i> | | 1 | * | | |
| <i>Macrargus rufus</i> | 9 | 14 | | * | |
| <i>Bathyphautes gracilis</i> | 4 | 3 | * | * | |
| <i>Bathyphautes parvulus</i> | | 8 | | | |
| <i>Diplostyla concolor</i> | 4 | 8 | | | |
| <i>Tapinopa longidens</i> | | 4 | | | |
| <i>Stemonyphantes lineatus</i> | 2 | 2 | | | |
| <i>Leptyphantes minutus</i> | P | | | | |
| <i>Leptyphantes tenuis</i> | 26 | 4 | *Ad | * | |
| <i>Leptyphantes zimmermanni</i> | 3 | 1 | | | |
| <i>Leptyphantes flavipes</i> | 1 | 7 | * | | |
| <i>Leptyphantes ericaeus</i> | 36 | 22 | * | * | |
| <i>Leptyphantes pallidus</i> | 1 | | | | |
| <i>Linyphia triangularis</i> | | 2 | | | S |
| <i>Linyphia clathrata</i> | | 9 | | | |
| Total | 265 | 258 | | | |
| Species | 24 | 32 | | | |
| Total species | 55 | | | | |

Book review

Creating new native woodlands. J. Rodwell and G. Patterson. Forestry Commission Bulletin No. 112. The Forestry Authority (HMSO). 1994. 74 pp. £8.95. ISBN 0 11 710320 9.

For many years the Forestry Commission's contribution to conservation was, to say the least, limited. A great deal of damage to natural communities and sites of major conservation interest has been done in the name of forestry under their management. In the last few years the Forestry Authority at least (now distinct from a sister organization Forest Enterprise) has taken substantial steps towards a more sensitive approach to the growing of trees, and has even started to recognize that timber from native tree species has real value. More recently they seem to have accepted the idea that trees are part of a complex living community, and they have begun to make a contribution to the conservation and even restoration of some of our most threatened habitats, especially native woodlands. The publication of *Creating new native woodlands* is an admirable example of this most recent trend.

Gordon Patterson is a Forestry Authority man who has joined forces with John Rodwell, a leading conservation botanist and one of the major contributors to the new National Vegetation Classification at the Unit of Vegetation Science, Lancaster University. Their book describes in detail the different types of native woodland (as defined by the NVC system), its distribution and some of the reasons for its variation. They also detail the characteristic ground flora, shrubs and other plants found in woodland that is primarily defined by the species composition of the tree layer. They then describe various methods of encouraging and re-creating the features of the native woodland types including preparation, planting and subsequent management such as the introduction or control of grazing animals and the role of invading plant species and natural regeneration. It is effectively a handbook for woodland management as well as a guide to restoration, but is also of considerable interest to the general naturalist who wants to identify the wood in which he may be bird-watching, moth-trapping or even just picnicking.

The whole concept of the management of sites is now a matter that impinges on every naturalist. We have all witnessed or heard about so many events or practices that have caused sites to deteriorate or disappear altogether. The new science of ecological restoration has hardly made much impact here yet, although a UK chapter of the American-based Society for Ecological Restoration was recently inaugurated in Bristol. If we are to manage our sites better, and hopefully contribute also to the major enterprise of restoring some of our lost woodland, it is books like this that we will increasingly need. Messrs Rodwell and Patterson and the Forestry Authority are to be congratulated for contributing to a most important project.

J. E. D. MILNER

Spider records for the London Area in 1993

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Introduction

The year produced two most unusual finds and several others of interest. The pan-tropical theridiid *Coleosoma blanda* was taken in a pitfall trap in Queen's Wood; this was the first record of the species outside the tropics and naturally a new British record. Secondly an unusual specimen of the linyphiid genus *Porrhomma* was identified as one of only a handful of specimens assigned to a new species *P. cambridgei* by Peter Merrett (in press). Other new records for London were *Xysticus lanio*, *Ozyptila praticola* and *Walckenaeria dysderioides*, all from Oxleas Wood, and for Middlesex *Agalenatea redii* from Monken Hadley Common, and *Centromerus incilium* from Ruislip Common, *Lessertia dentichelis* from Coldfall Wood, as well as the first recent (i.e., post-1957) record for *Clubiona trivialis* from Hounslow Heath.

Several of these new records are from pitfall traps, others result from sweeping vegetation or from sorting grass and litter. Pitfall trap results do suggest that certain species occur in very small numbers: *Zelotes apricorum*, *Agroeca brunnea*, and *Ozyptila praticola* are examples of species which have not so far been found by other methods and have occurred even in traps only as very occasional individuals. These may be examples of relic populations that were formerly much larger before their habitat was largely destroyed by the expansion of London.

All records are by the author unless stated. New records for the old LCC area of London are marked *, and for Middlesex **.

GNAPHOSIDAE

A second male *Zelotes apricorum* was taken in a pitfall trap in the glade ('Lovers Lawn') at Coldfall Wood in June; this is still the only known locality in the two counties.

CLUBIONIDAE

A single female *Clubiona trivialis*** was found among grass at Hounslow Heath in May. This diminutive mouse-spider has not been recorded in Middlesex before; in London there are old records (Savory and Le Gros 1957) including the Cripplegate bombed site in the 1940s, but it has not been recorded since 1957.

A single male of *Agroeca brunnea* was taken in a pitfall trap in the glade at Coldfall Wood. This species was known from several sites in the London Area including Hampstead Heath before 1957, but this is the first contemporary record.

ANYPHAENIDAE

A female *Anyphaena accentuata* was swept from vegetation along the southern edge of Oxleas Wood in June; this is the only contemporary record in London, although the species has been found at Monken Hadley Common in Middlesex where males and females have been taken by the author, although these finds were not previously reported.

THOMISIDAE

A single female *Xysticus lanio** was swept from the vegetation along the southern edge of Oxleas Wood in May, and a single male *Ozyptila praticola** was taken in a pitfall trap inside Oxleas Wood in June. This is the first London record, although it has been recorded from the leaf litter of several woods in Middlesex.

SALTICIDAE

Two further specimens of *Ballus chalybeius (depressus)* were taken at Oxleas Wood, this time in pitfall traps inside the wood, whereas the previous record was from the vegetation along its southern edge.

HAHNIIDAE

Many specimens of *Hahnia helveola* were taken during winter pitfall-trapping at Oxleas Wood. This is still the only known site in London, but it is clearly one of the most abundant litter-inhabiting species during several winter months at Oxleas.

THERIDIIDAE

The extraordinary find of a single female of the tiny *Coleosoma blanda** (a species that resembles a tiny, emaciated *Cyclosa conica* in general shape), in a pitfall trap in Queen's Wood was quite mystifying. The site was near the middle of the wood in deep leaf litter densely shaded by an oak tree; the spider was described from specimens taken in low vegetation but above the ground in Malaysia, so its presence in leaf litter is a further surprise. It could conceivably be a small item of evidence that southern species are colonizing this country due to global warming, but until further specimens are found it must be treated with caution. New species are found in this country nearly every year and some of these appear to be in the process of extending their range northwards, but this find is rather more unusual. However it is very small (less than 2 mm) and is easy to overlook, especially among leaf litter. More specimens are clearly needed!

ARANEIDAE

Both males and females of *Agalenatea redii*** were taken sweeping holly bushes at Monken Hadley Common in early May. Further specimens of the small orb-web spinner *Mangora acalypha* were swept from vegetation at Hounslow Heath in May. This is still the only site from which the species has been recorded in either Middlesex or London; it is very common on heathland in parts of the south of England.

LINYPHIIDAE

Both males and females of the tiny litter-inhabiting *Walckenaeria dysderioides** were taken in pitfalls during winter trapping at Oxleas Wood in December.

A single male *Entelecara acuminata* was found at Monken Hadley Common in May; the only other recent records are from Darlands Lake and Coldfall Wood.

Single females of both *Porrhomma pygmaeum* and *P. campbelli* were taken in pitfall traps at Oxleas Wood (in May and June respectively). These are both very uncommon in London, and the only other known locality for either is Hampstead Heath.

A single female of the tiny *Panamomops sulcifrons* was taken in a pitfall trap in June in the glade at Coldfall Wood; this diminutive species, the 'horned spider', has now been taken from a total of seven sites in the two counties, some of them rather disturbed habitats (Regent's Park and Crouch End Open Space).

A single male *Lessertia denticheleis*** was taken in a pitfall trap in the second recoppiced area at Coldfall Wood on 1 January 1993, representing a catch made over the previous three weeks. This is the first record of this characteristically orange-brown species for Middlesex; it has been reported once from London (Milner 1987) from a derelict site (since built on) adjacent to Greenwich Marsh. *L. denticheleis* is known generally as a species of culverts, caves and sewers; the two records from the London Area seem somewhat anomalous.

Two males of the uncommon *Centromerus incilium*** were taken during the field trip to Ruislip Common in December.

Acknowledgement

I would like to thank Peter Merrett for his help in identifying several of the spiders, in particular most of the new records.

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Survey of Bookham Common

FIFTY-SECOND YEAR

Progress Report for 1993

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General (Bryan Radcliffe)

When our former chairman, Geoffrey Beven died in 1990 it was thought by many that his would be a hard act to follow. Brad Ashby who succeeded him, quickly showed his ability to do just that. Unfortunately, Brad was only spared for four years and we are sad to report his death in January 1994. He will be greatly missed. His activities, even on the limited canvas of Bookham Common, were wide. They ranged from the mundane but welcome regular provision of biscuits, through the technical expertise to design and construct a clever racking system for the library, and a novel photo-viewer, to the collection of microscopic flora and fauna from our ponds (just one of his many interests) followed by learned dissertations on these in yearly Progress Reports. More details about Brad will be found in his obituary on pages 221–224. However, we are now pleased to report that Dr Ian Menzies has been appointed chairman.

We were also pleased to welcome two new members in 1993, Rose Pride and Keith Boshier. No doubt their names will become familiar to readers of *The London Naturalist* in due course.

The project to examine the effect of stock-grazing on the diversity of plant species has reached a stage worth reporting. Details of this are on pages 165–170, and it is proposed to continue the project for some years.

In recent times we have revised our views on the delimitation of the two birches and their hybrid. A project has been started to investigate the actual occurrence of the three taxa at Bookham.

Back to the mundane again, we can report the acquisition of toilet facilities close to the Research Hut, made possible by collaboration between the LNHS and The National Trust.

As usual, we need new members. The Survey has been in progress for more than fifty years and much knowledge has been accumulated by generations of workers. It would be wrong however to assume that little remains to be accomplished. The Common is a dynamic ecosystem, changing all the time, so every year brings new interest and new problems to investigate. It is to be hoped that the Common will be immortal, but naturalists are certainly not, so please come and join in. A new generation is needed to support, and eventually supplant, the old. Expert and beginner, both will be equally welcome, and both will do valuable work.

Management work on the Bookham Commons (Ian F. Swinney, National Trust Warden)

The objectives of The National Trust's management of the Bookham Commons are

to maintain and enhance the area with regard to nature conservation, landscape and amenity value. Whilst undertaking tasks for the first, the last two requirements are met by creating and maintaining open grassland, scrub communities, shaded footpaths, wide rides with scalloped edges, glades, ponds and wetlands, etc. The variety of habitats, and therefore the diversity of associated wildlife, is being maintained for future generations to appreciate and enjoy. To secure long-term survival of plants and animals it is also necessary to ensure that population sizes are adequate. For example, a small area of grassland or other habitat may contain insufficient numbers of any one species to provide security against fluctuations in population caused by natural variations in climate. While the requirements of individual species need to be catered for, a broader outlook is essential in the management of habitats (undertaken on a rotational basis to minimize disturbance) to ensure that interests in landscape and amenity are also satisfied.

The recently cleared areas of Bayfield and Isle of Wight Plains rapidly became colonized by ruderal species, but many of the perennials have now become established making it difficult to distinguish these areas from the surrounding grassland. Unfortunately further clearance of scrub and trees has not been possible due to the very wet winter. Cattle-grazing on Central Plain is continuing to show improvement, the taller rank grasses being eaten down, and trampling seeming to encourage a greater diversity of flora. The tussocks of grass that remain provide an excellent habitat for mice, voles and shrews, and shelter for invertebrates.

The mixed-age scrub also provides good shelter and is the main nesting place for bird life. The nightingales were again present in good numbers suggesting that the conditions maintained at Bookham suit them, though factors such as prevailing weather conditions and survival of migration hazards are obviously important also. A full survey of the ponds and wetland areas has been commissioned by the Trust and the LNHS Survey Team will be consulted regarding any recommendations along with the National Rivers Authority.

One of the major operations for 1993 was the selective felling of 150 pedunculate and Turkey oaks *Quercus robur* and *cerris* along Woodland and High Point paths, together with thinning in the coppice area in Eastern Wood. Press releases, radio appearances, on-site notices and high-profile wardening were undertaken at the time of felling and extraction, but there were a few objections locally. Tree-felling is always an emotive subject, but failure to manage our woodlands properly, and continuing in doing so, to bear a responsibility undertaken for thousands of past years, will result in the loss of many creatures and aspects of wildlife that we now treasure. To assist the maintenance, the purple emperor butterfly *Apatura iris*, which has been scarce since the poor summer of 1988, along with the white admiral *Ladoga camilla*, trees chosen for selective felling were marked with the assistance of Ken Willmott of the British Butterfly Conservation Society. The approval of English Nature (formerly NCC) and the Forestry Authority (Forestry Commission), also required, was obtained for this work.

By selective thinning of the trees we hope to create cleared areas for plant and animal species to colonize at ground level, while being careful to avoid too much disturbance of the existing arboreal habitats. The scalloping of the ride edges creates areas that have both shade and sunlight and encourages a wider variety of both plant and animal species. Woodland edges are associated with the greatest variety of wildlife, and provision of suitable glades and further areas of coppiced woodland are essential in maintaining the variety of butterflies and other invertebrates along with birds and mammals. As its name implies, Glade Path has a clearing halfway along its route, and this was enlarged in the autumn of 1993. Our conservation volunteers also created another glade on Tunnel Path near Eastern Plain.

Invasive plant species, such as sycamore *Acer pseudoplatanus* and Himalayan balsam *Impatiens glandulifera*, are being monitored, the latter having spread through two acres of woodland near Mark Oak Gate. There is a view that these plants could be self regulating and become part of the existing ecosystems, but the Himalayan balsam,

being unpopular with native herbivores, is growing well (even amongst bracken!) without its companion plants, and spreading at an alarming rate. Efforts have been made at least to contain it with the help of volunteers pulling it up before it seeds. With a ten-year seed life we are committed to a fair amount of work in this area! Along watercourses it does not tend to dominate the other vegetation which is also vigorous, so we may not need to be so anxious!

The survey by the LNHS is of great value in the management of the Bookham Commons and there are many more opportunities for study. Visitors, and especially offers to support the Survey Team, are always welcome.

Vegetation (Ken Page)

Some decreasing and uncommon species

Bookham Common does not have a national rarity but does have some decreasing and uncommon plants, particularly at local level.

Most at risk is heath dog-violet *Viola canina*. As the common name suggests it requires a 'heathy' habitat where competition from other plants is usually minimal. Here, on the London Clay, competing vegetation is too vigorous for this attractive violet. One plant with several offsets survives.

Saw-wort *Serratula tinctoria* with flowers resembling a miniature knapweed has a much reduced population — five plants only were seen last year. Encroaching brambles may be partly responsible for the reduction, but the plant is decreasing in other parts of Surrey.

Another greatly diminished plant is petty whin *Genista anglica*. It is known mainly from one area where it grows with purple moor grass, carnation sedge, alder buckthorn and other plants preferring an acid soil. Meadow thistle *Cirsium dissectum* also grew here, but was lost after the abnormally hot dry summer of 1976.

Separating downy birch *Betula pubescens* from the hybrid between this species and common birch *B. pendula* is difficult. However, recent observations appear to indicate that downy birch has significantly decreased, leaving common birch and the hybrid as the two main *Betula* taxa. A survey has recently been initiated which will attempt to confirm these findings.

Of the uncommon species that still maintain themselves here the most notable is thin-spiked wood sedge *Carex strigosa*. First found in 1968, its population is little changed. Growing in a damp area on the edge of the Common, the colony may enjoy some protection from nearby brambles.

Meadow brome *Bromus commutatus*, discovered by Olive Maunder ten years ago, is a very local grass. As an annual its renewal can be precarious and unpredictable, but it manages to produce plants most years. On one occasion, five hundred were counted. Clearly the seed bank is satisfactory — much will depend on the habitat in future years.

The genus *Potamogeton* is not well represented at Bookham. After pond clearance small pondweed *P. berchtoldii* appeared in 1979. It is a scarce species locally, and is the first record for the Common. The present population is somewhat reduced.

Eared sallow *Salix aurita* is locally rare. We have two mature bushes which for many years were not observed. First recognized and named by Rod Stern in 1972, they have surely existed here for many years, probably from earlier decades of this century. Good management since the discovery is largely responsible for the present-day good health of the plants.

Grazing for diversity (Bryan Radcliffe)

Introduction

Until the middle years of this century Bookham Common, like many other areas of common land in Britain, was a valued source of food for farm animals. At one time most of the southern half was in use in this way and was, broadly speaking, open grassland.

Between the two wars alterations in farming practices and no doubt a number of other constraints led to a progressive decline in this use of the Common, culminating in complete cessation of grazing in 1949. As a consequence shrubs and trees, previously unable to survive the attentions of the animals, started to invade the area. Botanical surveys carried out in 1953 and in the late seventies provided data that showed clearly how shade-tolerant plants were advancing and light-demanding plants were retreating across the formerly open plains.

Both the local National Trust committee and the Bookham Survey team have for a long time considered that it would be advantageous if controlled stock-grazing could be re-introduced. We thought that this would have the effect of enhancing the diversity of the flora, and consequently the diversity of species-specific fauna, and even, hopefully, other fauna.

Ways and means

In 1989 The National Trust completed negotiations with a local stock farmer and fenced, at no small cost, a portion of Central Plain. The necessary stiles and gates were included to allow full access by the public, as hitherto. The area fenced was approximately 5.3 hectares (13 acres) and was wholly within division 'R' of the Bookham Survey. The terrain included part of the stream known as Isle of Wight Ditch and the habitat was partly of grassland with scattered scrub, some recently 'swiped' scrub, some mature and impenetrable blackthorn scrub and some young woodland, principally of oak and hawthorn.

In order to monitor changes in the flora, the Bookham team established six quadrats. It was of course essential to allow the animals unrestricted access to their vegetation. On the other hand it was necessary to be able to relocate the quadrats with precision. We adopted the technique of placing one substantial permanent post at the north-east corner of each. The quadrats could then be laid out rapidly when needed by the use of compass, pegs and pre-measured cord. The quadrats were square, of 2 metres side.

Selection of quadrat locations

In scientific work it is customary to locate quadrats in a strictly random manner in order to avoid observer bias. On this particular terrain such an approach would be likely to place at least half the quadrats in impossible situations such as the stream bed or impenetrable scrub. It was therefore decided to select quadrat positions with definite, conscious bias. The following criteria were applied in selecting the six:

- QUADRAT A in an area known to contain at least one individual of *Dactylorhiza praetermissa* (a local species whose continuing success was of interest to us).
- QUADRAT B in an area known to contain at least one individual of *Ophioglossum vulgatum* (a local species whose continuing success was of interest to us).
- QUADRAT C in an area containing many short stems of *Prunus spinosa*, 'swiped' the previous year (1988).
- QUADRAT D in an area which had been, and continued to be, subject to grazing pressure by rabbits.
- QUADRAT E in a shallow depression dominated by *Juncus* and *Deschampsia cespitosa*, otherwise apparently poor in species.
- QUADRAT F in an area containing several woody species, including *Prunus spinosa*, about 1.5 metres high, not recently swiped.

The six quadrats were not less than 40 metres apart, within a circle of radius some 200 metres.

By chance quadrat B was under the canopy of a medium-sized oak and was subject to considerable shade. It is probable that plants within it received scarcely any direct sunlight and then only late on a summer day. Quadrat E was also near a tree, but since this was clear of branches to a reasonable height the effect of shading would be small. The other four quadrats were in positions receiving virtually full illumination.

Table 1 details the number of animals and the periods allowed for grazing during the years of the investigation.

TABLE 1. Numbers of animals and the periods allowed for grazing during the investigation.

| Year | Animals grazing | Period of grazing |
|------|-----------------|--------------------------------|
| 1989 | Six cows | 3 months (July – September) |
| | Nine cows | 2 months (November – December) |
| 1990 | Eight cows | 1 month (June) |
| | Eight cows | 1 month (November) |
| 1991 | Three cows | 5 months (June – October) |
| 1992 | Five cows | 5 months (June – October) |
| 1993 | Seven cows | 3 months (May – July) |
| | Three cows | 3 months (August – October) |

The lack of uniformity in the grazing regime was largely due to yearly variations in weather patterns, which resulted in irregular availability of herbage for the cows. It was of course obligatory to allow the farmer to decide when and at what density to put the cows on the land.

Plant monitoring commenced in June 1989, one month before the cows were introduced. Some plants were unidentifiable to species level on the first visit, so successive monthly visits were made during the summer to make the list as complete as possible. A few species (? grasses) may have been missed as a result of their flowering stems being eaten off, but the number is unlikely to be large. Results from all visits in the year were consolidated as a single yearly list.

After 1989, recording was discontinued until 1993 so as to allow sufficient time for significant change to occur. The same recording procedure was then adopted in 1993. The full list of the two years' records is given in the Appendix.

Physical evidence of the cows' trampling activities was not obvious except where they were 'channelled' by the necessity of walking in narrow gaps between shrubs. No distinct hoof marks were noticed in any of the quadrats themselves.

Discussion of results

As might be expected, the plants recorded were characteristic of division R of the Common. All had been found in that division in the previous major survey (Radcliffe and Page 1981) with the exception of *Holcus mollis* and *Rumex* × *pratensis*. The former is generally associated with mature woodland although it is sometimes encountered in open grassland also. The *Rumex* hybrid is perhaps a special case. It is not likely to have come in from outside the division and will most probably have been created in or adjacent to the quadrat. Both parents are common in the division.

Overall tallies for the six quadrats were 164 records of 76 species in 1989 and 198 records of 92 species in 1993. Sixty-seven species were common to both surveys although not always in the same quadrat.

Table 2 shows data relating to individual quadrats, derived from the full lists in the Appendix.

Perhaps the most important result is that five of the six quadrats showed a nett gain in species between 1989 and 1993. This is good evidence for an enhancement in species diversity. The only quadrat subject to a nett loss was B, and it is virtually certain that the main reason for this was the factor unique to this quadrat, namely, the lack of light. Nevertheless, the *Ophioglossum* was retained (in good numbers) and five new species arrived, eleven having been lost.

In the absence of evidence to the contrary it is reasonable to assume that the original assembly of species would have been relatively stable in quadrat B had there been no grazing. The implication then emerges that grazing is a factor for change that can act

TABLE 2. Data relating to individual quadrats derived from the full lists in the Appendix.

| Quadrat | Total records 1989 (Q) | Total records 1993 (R) | 'Unique' 1989 (S) | 'Unique' 1993 (T) | Present in both years (U) | Present only in 1989 (V) | Present only in 1993 (W) | Total species both Years (X) (U+V+W) | Nett change (R-Q) | % change (100 $\frac{v+w}{x}$) |
|---------|---------------------------------|---------------------------------|-------------------------|-------------------------|------------------------------------|-----------------------------------|-----------------------------------|---|-------------------------|---------------------------------------|
| A | 30 | 44 | 7 | 11 | 22 | 8 | 22 | 52 | +14 | 58 |
| B | 27 | 21 | 7 | 2 | 16 | 11 | 5 | 32 | -6 | 50 |
| C | 30 | 34 | 4 | 3 | 25 | 5 | 10 | 39 | +4 | 36 |
| D | 27 | 37 | 4 | 9 | 23 | 4 | 14 | 41 | +10 | 44 |
| E | 21 | 29 | 3 | 3 | 14 | 7 | 15 | 36 | +8 | 61 |
| F | 29 | 33 | 10 | 13 | 23 | 6 | 10 | 39 | +4 | 41 |

positively or negatively, leading to enhancement if other conditions are favourable or to impoverishment if they are not.

The potency of this factor for change is undeniable. In the relatively short period of the investigation the most stable quadrat experienced a change in species content of 36 per cent. The least stable quadrat changed by a massive 61 per cent. Such changes are all the more remarkable when it is realized that a large majority (87 per cent) of the species involved were either perennials or woody plants, and therefore potentially a community of reasonable stability.

Another feature worthy of comment was the surprising degree of individuality of the quadrats although there had been no attempt to select quadrats with this in mind. In 1989, of the 76 species recorded, 35 occurred only once (they were 'unique' to single quadrats). In 1993, of the 92 species, 41 occurred only once. This individuality can be demonstrated another way by considering the overall tallies for each year. It emerges that the mean *records per species* was only 2.15 in 1989, and (by coincidence) almost exactly the same in 1993.

The total number of species recorded in these very small areas was a remarkably large proportion of the species recorded in division R in the major survey of the late seventies. It is curious that as many as 40 per cent of the division's species occurred in 24 square metres, which is less than one five-thousandth of the division.

Considering broad types of vegetation, there was a small nett loss of shrub/tree records although no species was completely lost. There was a small but definite gain in species and records of grasses. Both of these trends might well be an expected result of grazing and trampling activity.

Cirsium arvense is an abundant and tenacious component of division R and demonstrated its resistance to cattle by remaining present in all six quadrats. Nevertheless, it did not show any sign of assuming dominance.

Holcus lanatus, *Stellaria graminea* and *Veronica chamaedrys* were not present in all quadrats in 1989, but by 1993 had increased to occupy all. *Cerastium fontanum*, initially absent, occupied four by 1993. It is perhaps worth noting that the most successful colonizers, *S. graminea*, *V. chamaedrys* and *C. fontanum* are all low-growing plants with no particular adaptive features to aid seed dispersal. It is likely that their seeds were readily transported on muddy hooves.

Angelica sylvestris shared with *Cirsium arvense* the distinction of being present in all quadrats when we started. By the beginning of 1993 it had diminished to two quadrats. A watch was kept on the remaining two and it was noted that by July 1993 all the *Angelica* leaves in these had been eaten off. This raises the interesting possibility that cattle may be particularly partial to this aromatic plant.

Galium uliginosum is an uncommon plant in the region and Burton (1983) noted it in only 19 of the 856 tetrads. Nevertheless, it is quite frequent at Bookham, and our records show it to be more widespread there than the better-known and usually commoner *G. palustre*. This is reinforced by the quadrat surveys which had

G. uliginosum in all six quadrats, though not simultaneously. *G. palustre* was not seen in any.

An even more uncommon species is *Agrimonia procera* and it was pleasing to note it in three of the six quadrats.

Conclusions

It would be very interesting to continue the investigation to examine the effects of longer-term grazing. Nevertheless, it is considered that the work to date has established that grazing, at least in the short term and accompanied by favourable growing conditions, is capable of enhancing the diversity of plant species.

It is hoped that The National Trust will be prepared to extend the current arrangements with the farmer until at least 1997, when another survey of the quadrats will be appropriate. We are confident that valuable information will be forthcoming.

Acknowledgements

Thanks are due to members of the Bookham Survey team for assistance and support. They included Keith Bosher, Olive Maunder, Ken Page, Rose Pride, Joan Stoddart and, alphabetically last, but not least, the NT Warden, Ian Swinney who not only helped with monitoring, but unerringly relocated our quadrats when the cows knocked down the posts!

References

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APPENDIX

Plants recorded during 1989 and 1993.

× — present in 1989 and 1993, 9 — present only in 1989, 3 — present only in 1993

| Quadrats | | | | | | Quadrats | | | | | |
|----------------------------------|---|---|---|---|---|----------|---|---|---|---|---|
| A | B | C | D | E | F | A | B | C | D | E | F |
| <i>Acer campestre</i> | | | 3 | | | | | 3 | | | |
| <i>Achillea millefolium</i> | | | | | × | | 9 | | 3 | 9 | |
| <i>Achillea ptarmica</i> | | × | | | × | × | 9 | | | | |
| <i>Agrimonia eupatoria</i> | 3 | | 3 | | × | | | 9 | × | 9 | |
| <i>Agrimonia procera</i> | | | × | × | | 3 | | | | | |
| <i>Agrostis capillaris</i> | × | 9 | × | × | × | | × | × | 3 | 9 | × |
| <i>Agrostis gigantea</i> | | | | | 3 | | | | | | |
| <i>Alopecurus pratensis</i> | 9 | | | | 3 | | | | | | |
| <i>Angelica sylvestris</i> | × | 9 | 9 | 9 | × | 9 | | | | | |
| <i>Anthoxanthum odoratum</i> | | | | × | | | | | | | |
| <i>Arrhenatherum elatius</i> | × | | × | | 9 | × | × | × | 3 | × | × |
| <i>Bromus hordeaceus</i> | | | | | 9 | | | | | | |
| <i>Calystegia sepium</i> | 9 | | | | × | | | | | 9 | |
| <i>Cardamine pratensis</i> | 3 | × | | | | | 3 | | | × | |
| <i>Carex flacca</i> | | | 3 | | | | 9 | × | × | × | 9 |
| <i>Carex hirta</i> | | | × | × | | | | | | | 3 |
| <i>Centaurea nigra</i> | | | | | × | | × | 9 | | | × |
| <i>Cerastium fontanum</i> | 3 | 3 | | 3 | 3 | | | | | 3 | |
| <i>Chamerion angustifolium</i> | | | | | 9 | | | | | | × |
| <i>Cirsium arvense</i> | × | × | × | × | × | × | | | 3 | | |
| <i>Cirsium palustre</i> | 3 | | × | × | 3 | | | × | × | × | × |
| <i>Cornus sanguinea</i> | | | | 3 | | | 9 | | | | |
| <i>Crataegus monogyna</i> | 9 | 9 | × | × | × | | 3 | | × | | |
| <i>Dactylis glomerata</i> | | | | 3 | | | | | | × | |
| <i>Dactylorhiza praetermissa</i> | × | | | | | 3 | × | | | | |
| <i>Deschampsia cespitosa</i> | | × | | | × | | | 3 | 9 | | |
| <i>Dipsacus fullonum</i> | 3 | | | | 3 | | | | 3 | 3 | |
| <i>Epilobium ciliatum</i> | | × | | | | | 3 | | | | |
| <i>Epilobium hirsutum</i> | | 9 | | | | | | × | 3 | 3 | |
| <i>Epilobium montanum</i> | 3 | 3 | | | | | | | 3 | 3 | |
| <i>Epipactis helleborine</i> | | | | | 3 | | × | × | 3 | 9 | 3 |
| <i>Festuca rubra</i> | 3 | | × | 3 | | | × | × | | | |
| <i>Filipendula ulmaria</i> | | | | | | | | 3 | | | |
| <i>Fraxinus excelsior</i> | | | | | | | | 9 | | 3 | 9 |
| <i>Galium aparine</i> | × | 9 | | | | | | | | | |
| <i>Galium saxatile</i> | | | | | | | | 9 | × | 9 | |
| <i>Galium uliginosum</i> | × | × | × | | | | × | × | 3 | 9 | × |
| <i>Geranium dissectum</i> | 3 | | | | | | | | | | |
| <i>Geum urbanum</i> | 3 | | | | | | | | | | |
| <i>Glechoma hederacea</i> | × | × | | | | | | | | | × |
| <i>Heracleum sphondylium</i> | 9 | | | | | | | | | | 3 |
| <i>Holcus lanatus</i> | × | × | 3 | | × | × | × | | × | × | × |
| <i>Holcus mollis</i> | | | | | | | | | | | 3 |
| <i>Hypericum perforatum</i> | | | | | | | | | 9 | | |
| <i>Juncus conglomeratus</i> | | | | | | | | | | 9 | |
| <i>Juncus effusus</i> | | | | | | | 3 | | | × | |
| <i>Juncus inflexus</i> | | | | | | | 9 | × | × | × | 9 |
| <i>Lapsana communis</i> | | | | | | | | | | | 3 |
| <i>Lathyrus pratensis</i> | × | | 9 | | | | | | | | × |
| <i>Lolium perenne</i> | | | | | | | | | | 3 | |
| <i>Lonicera periclymenum</i> | | | | | | | | | | | × |
| <i>Lotus corniculatus</i> | | | | | | | | | 3 | | |
| <i>Lotus uliginosus</i> | | | | | | | | × | × | × | × |
| <i>Moehringia trinervia</i> | 9 | | | | | | | | | | |
| <i>Myosotis arvensis</i> | 3 | | | | | | | | × | | |
| <i>Odontites verna</i> | | | | | | | | | | × | |
| <i>Ophioglossum vulgatum</i> | 3 | × | | | | | | | | | |
| <i>Pastinaca sativa</i> | 3 | | 3 | | | | | | | | |
| <i>Plantago lanceolata</i> | | | | | | | | | 3 | 3 | |
| <i>Plantago major</i> | 3 | | | | | | | | | | |
| <i>Poa annua</i> | 3 | | × | | | | | | 3 | 3 | |
| <i>Poa pratensis</i> | | | | | | | | | 3 | 3 | |
| <i>Poa trivialis</i> | × | × | 3 | | | | | | | 9 | 3 |
| <i>Potentilla anserina</i> | | × | × | | | | | | | | |

| | Quadrats | | | | | | | Quadrats | | | | | |
|---------------------------------|----------|---|---|---|---|---|---------------------------------|----------|---|---|---|---|---|
| | A | B | C | D | E | F | | A | B | C | D | E | F |
| <i>Potentilla erecta</i> | | | | × | | × | <i>Senecio erucifolius</i> | | | 9 | | | |
| <i>Potentilla reptans</i> | × | × | × | × | 3 | | <i>Senecio jacobaea</i> | 3 | | | | | |
| <i>Prunella vulgaris</i> | | × | | | | | <i>Sonchus arvensis</i> | 9 | 9 | | | | |
| <i>Prunus spinosa</i> | × | 9 | × | 3 | | × | <i>Stachys sylvatica</i> | | | | | | 9 |
| <i>Pulicaria dysenterica</i> | 3 | 9 | × | | | | <i>Stellaria graminea</i> | × | 3 | × | × | 3 | × |
| <i>Quercus cerris</i> | | | | | | × | <i>Stellaria holostea</i> | | | | | × | × |
| <i>Quercus robur</i> | | | | × | | 9 | <i>Taraxacum officinale</i> agg | 9 | | × | × | | 3 |
| <i>Ranunculus ficaria</i> | × | | | | | | <i>Torilis japonica</i> | × | | | | | |
| <i>Ranunculus repens</i> | × | × | 3 | × | 3 | | <i>Trifolium pratense</i> | | | × | | | |
| <i>Rosa canina</i> | | | × | 9 | × | | <i>Trifolium repens</i> | 3 | × | | | 3 | 3 |
| <i>Rubus fruticosus</i> agg. | 9 | × | × | | | | <i>Urtica dioica</i> | × | 9 | | | | × |
| <i>Rumex acetosa</i> | × | | × | × | × | × | <i>Veronica chamaedrys</i> | × | 3 | 3 | × | 3 | 3 |
| <i>Rumex conglomeratus</i> | × | | | | | | <i>Veronica serpyllifolia</i> | 3 | | | 3 | | |
| <i>Rumex crispus</i> | | | | 3 | 3 | | <i>Vicia cracca</i> | | | | | | × |
| <i>Rumex obtusifolius</i> | 3 | | 3 | | | | <i>Vicia hirsuta</i> | | | | | | × |
| <i>Rumex</i> × <i>pratensis</i> | 3 | | | | | | <i>Vicia sativa</i> agg. | | 9 | | × | | |
| <i>Rumex sanguineus</i> | 3 | × | | | | | <i>Vicia tetrasperma</i> | × | | × | × | 3 | × |
| <i>Salix caprea</i> | | | | | 9 | × | <i>Viola riviniana</i> | | | × | × | | |
| <i>Scrophularia auriculata</i> | 3 | | | | | | | | | | | | |

A survey of digenean parasites in molluscs from Isle of Wight Pond and Western Hollow Pond (Ruth S. Kirk)

Many molluscs act as the hosts of larval stages of digenean flukes (phylum Platyhelminthes, class Digenea) which parasitize fish, birds and mammals. Samples of molluscs from Isle of Wight Pond and Western Hollow Pond were collected on 23 June and 27 September 1993 and examined to determine if they were infected with digenean parasites. A total of 160 molluscs was removed from Isle of Wight Pond on each sampling date consisting of samples of lake limpet *Acroloxus lacustris*, river limpet *Ancylus fluviatilis*, bladder snail *Physa fontinalis*, pea mussel *Pisidium* sp., whirlpool ramshorn *Planorbis vortex*, Jenkins' spire snail *Potamopyrgus antipodarum* (previously known as *Potamopyrgus jenkinsi*, see Brown (1994)) and horny orb mussel *Sphaerium corneum*. A total of 220 snails was collected from Western Hollow Pond on each date consisting of samples of *A. lacustris*, ear pond snail *Lymnaea auricularia*, marsh snail *Lymnaea palustris*, wandering snail *Lymnaea peregra*, white ramshorn *Planorbis albus*, flat ramshorn *Segmentina complanata* (was *Planorbis complanatus*), *Planorbis vortex*, *Physa fontinalis*, *Pisidium* sp. and *S. corneum*. Molluscs were identified using Macan (1977) and Fitter and Manuel (1986).

The molluscs were taken to the laboratory and screened for larval digeneans known as cercariae. The survey was permitted with the stipulation that the molluscs were returned to their original habitats in good condition and therefore cercarial screening was carried out by the cercarial emergence technique rather than by dissection. Individual molluscs were isolated in vials of water maintained at 20°C for three days. The water in each vial was then checked for emerging cercariae and changed every four hours from 8 a.m. – 8 p.m.

All the snails collected from the Isle of Wight Pond were uninfected. In the Western Hollow Pond samples, only one infected snail, a *Lymnaea palustris*, was found in June and again, only a single infected snail, a *Lymnaea peregra*, was detected in September (infection prevalence = 0.45 per cent). Both snails were infected with fork-tailed cercariae of the genus *Diplostomum* von Nordmann, 1892 (family Strigeidae), a widespread group of digeneans which parasitize the eyes of fish. This type of cercaria was previously identified as *Diplostomum spathaceum*, but it is now know that the 'species' covers a wide range of forms and that specialized techniques are required to distinguish between them. The level of prevalence of digenean parasites in the sampled molluscs was surprisingly low and therefore it would be interesting to carry out a similar parasite survey of the molluscs in subsequent years.

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Orthoptera (Ian S. Menzies)

On 13 and 14 August nymphs and adults of both the conehead bush-crickets *Conocephalus dorsalis* (Latreille) and *discolor* (Thunberg) were plentiful in grassy areas of the Western Plain, despite the poor summer weather. The colonies of *Pholidoptera griseoptera* (Degeer) have spread to several new areas. As yet there has been no further sign of Roesel's bush-cricket *Metrioptera roeselii* (Hagenbach), although it has become widespread and abundant in adjacent areas with similar ecology such as Epsom and Ashted Commons.

Hemiptera–Heteroptera (Ian S. Menzies)

Three nymphs, successfully bred out to confirm identity as the box bug *Gonocerus acuteangulatus* (Goeze), were beaten from a hawthorn bush near Merritt's Cottage, 14 August 1993. This would seem to confirm the attachment of this species to hawthorn *Crataegus monogyna* as an alternative to box *Buxus sempervirens*, which is absent from Bookham Common.

Coleoptera (Ian S. Menzies)

Two phytophagous beetles that appear to be new to Bookham Common have been noted during 1993. Three examples of *Lamprosoma concolor* (Sturm) were beaten from ivy by the Tunnel car park on 8 May 1993. The adult beetles eat the leaves of ivy, and the species has also been noted in some numbers this season in the Headley Warren/White Hill area north of Box Hill after many years of scarcity. *Galerucella viburni* (Paykull) was seen in large numbers feeding on the leaves of guelder rose *Viburnum opulus* in the garden of Merritt's Cottage, 13 August 1993. Holes have previously been noted on the leaves of guelder rose suggesting the presence of this species in the Eastern Plain area.

Lepidoptera (Ken J. Willmott)

Despite the poor July weather of 1993, with only ten days of temperature above 70°F, and some nineteen days with little or no sun during the middle part of the day, two of the most notable species on the Common, the white admiral *Ladoga camilla* and the purple emperor *Apatura iris*, did relatively well. This was in part due to the fact that both were early on the wing. The white admiral was first seen on 22 June, and the purple emperor on the 24th. This gave them some fine weather to mate and lay a proportion of their eggs before the unsettled weather of mid July thwarted their breeding activities.

The white admiral did particularly well, continuing its recovery from the disastrous season of 1988 when it plummeted to very low numbers. As a consequence of its abundance, the aberrations *nigrina* and *obliterae* (formerly *seminigrina*), were both seen by myself on every visit to the Common, *obliterae* being especially frequent. The white admiral was on the wing for a little over a month and four larvae were found on honeysuckle as early as 11 July.

A male purple emperor was seen imbibing moisture and sodium salts from dog excreta (plenty of choice on the Common!) on 2 July, allowing several photographs to be taken before flying off. A female was seen egg-laying last year on the vigorous vertical growth of a horizontal willow, blown over in the October 1987 storm, but, on account of the poor weather, no egg-laying was witnessed this year.

White-letter hairstreak *Strymonidia w-album* larval eatings were conspicuous this year, and I found nine pupae with relative ease, five on English elm and four on wych

elm, the species being evidently much more numerous than in previous years. One pupa found on 12 June hatched the next day. On 29 June two females were observed egg-laying, and two eggs marked out to follow their progress next spring were later destroyed when branches were cut off the elms during road resurfacing operations near Bank's Common.

The silver-washed fritillary *Argynnis paphia* persists at a very low frequency, observed as singletons each year. A brief survey for violet growth suitable for the larval stages was made in early April, and suitably sited plants were noticed, especially near High Point where I have seen this species most frequently.

Most of the Satyridae were less frequent than usual in 1993. This was particularly noticeable in the case of the meadow brown *Maniola jurtina* on the large Bank's Common meadow. Higher transect walk counts were obtained in previous years when the meadow had not been summer-grazed by cattle, but during the last two years summer-grazing has taken place and numbers have declined. A larva of the gatekeeper *Pyronia tithonus* was found during daytime in a tussock of the tufted hair-grass *Deschampsia cespitosa*, but was retarded in growth and found to have a parasite of the genus *Hyposoter* (Ichneumonidae: Campopleginae) which eventually mummified the larva before emerging itself.

Larval batches of the small tortoiseshell *Aglais urticae* were seen on 1 May (first generation) and 19 June (second generation), the caterpillars being minute in both instances, having hatched within twenty-four hours of discovery and being barely visible on the terminal leaves of the stinging-nettles. It has been interesting to see the red admiral *Vanessa atalanta* (another nettle-feeder) at the same time and exactly the same area inhabited by the purple emperor each year, sharing the same territory. While the purple emperors fly at the top of the canopy, red admirals are disputing their territory at a lower elevation. Several were seen again in such dispute on 28 June this year.

The cattle-grazed enclosure on the Central Plain continues to provide suitable conditions for the grass-feeding skippers and browns. The cattle do not seem to be browsing the small scrub which remains surrounded by tussocks of the appropriate taller grasses. Where the cattle have grazed down to a short turf, plants like birdsfoot trefoil flourish and provide food for colourful day-flying burnet moths (Zygaenidae) and also for the common blue *Polyommatus icarus*.

Odonata (Ruth Day)

Unfortunately 1993 was a rather disappointing year for dragonflies at Bookham Common. I spent nine days there between the end of May and the beginning of August and although I saw seven species over this period, because the weather was in general cold and wet, they were present in smaller numbers than last year (Day 1993).

I visited Lower Eastern Pond on 28, 29 and 30 May, but only the 29th was sunny. I caught 15 male *Coenagrion puella* on 28th, 54 on 29th and 18 on 30th. Because there were so few damselflies at the pond edge on the overcast days, there were no recaptures and no calculation was possible. Comparing the number of captures on the one sunny day in Table 1 with those of the previous year, however, shows no very great differences. My second attempt at mark/recapture at the end of July and beginning of August produced a little more data. The comparison of two representative days from

TABLE 1. Damselflies captured and marked at Lower Eastern Pond at the end of May.

| Date | <i>P. nymphula</i> ♂ | <i>P. nymphula</i> ♀ | <i>C. puella</i> ♂ | <i>C. puella</i> ♀ | <i>I. elegans</i> ♂ |
|---------|-------------------------|-------------------------|-----------------------|-----------------------|------------------------|
| 28.v.92 | 6 | 1 | 41 | 5 | 7 |
| 29.v.93 | 4 | 4 | 54 | 0 | 1 |

TABLE 2. Odonata captured and marked at Lower Eastern Pond at the end of July.

| Date | <i>C. puella</i> ♂ | <i>I. elegans</i> ♂ | <i>L. sponsa</i> ♂ | <i>L. sponsa</i> ♀ | <i>S. sanguineum</i> ♂ |
|-----------|-----------------------|------------------------|-----------------------|-----------------------|---------------------------|
| 15.vii.92 | 1 | 7 | 40 | 2 | 15 |
| 31.vii.93 | 4 | 9 | 15 | 0 | 15 |

1992 and 1993 shown in Table 2 indicates that the population of *Lestes sponsa* was much lower, but that *Sympetrum sanguineum* was present in similar numbers despite the poorer weather. The calculations, using Jolly’s stochastic method (Begon 1979, Day 1987–93) however, imply that *S.sanguineum* may still be increasing. If this is so, it is possible that the increase is associated with the steady march of *Typha latifolia*, which, albeit slowly is gradually taking over the pond.

South-East Pond, though still full of *Glyceria maxima*, had about six inches of water, which was considerably more than the previous year. It was therefore better for dragonflies. *Coenagrion puella*, *Lestes sponsa* and *Ischnura elegans* all occurred there in very low numbers. What was striking was that seven different male *Sympetrum sanguineum* (Hinnekindt 1974) had adopted this pond, which implies a potential

TABLE 3. Population estimates for *Lestes sponsa* and *Sympetrum sanguineum* using Jolly’s stochastic method.

| Year | <i>Lestes sponsa</i> ♂ | | <i>Sympetrum sanguineum</i> ♂ | |
|------|------------------------|-------|-------------------------------|-------|
| | Day 2 | Day 3 | Day 2 | Day 3 |
| 1992 | 249 | 328 | 42 | 21 |
| 1993 | 32 | 36 | 64 | 35 |

Note: In 1992, days 2 and 3 were 16 and 17 July, and in 1993 they were 31 July and 1 August.

population a third the size of that at Lower Eastern Pond. This has important management implications and suggests that no attempt should be made to reduce the *Typha* in Lower Eastern Pond until South-East Pond has fully recovered.

Sheepbell Pond and Kelsey’s Pond were visited twice: on 25 May and 5 June. *Pyrrhosoma nymphula*, *Libellula depressa* and *Coenagrion puella* were seen at both of them as well as at Lower Eastern Pond. *Anax imperator* and *Aeshna cyanea* were seen this year only at Kelsey’s and Lower Eastern Ponds.

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Birds (Ron Kettle)

The Common Birds Census was again carried out in the breeding season in 16-hectare Eastern Wood with 10 visits from mid March to late June — a little earlier than usual on account of the early spring. The numbers of estimated territories held by the various species were:

| | | | |
|--|----|--|----|
| Cuckoo <i>Cuculus canorus</i> | 1 | Long-tailed tit <i>Aegithalos caudatus</i> | 2 |
| Green woodpecker <i>Picus viridis</i> | 1 | Marsh tit <i>Parus palustris</i> | 2 |
| Great spotted woodpecker | | Coal tit <i>Parus ater</i> | 2 |
| <i>Dendrocopos major</i> | 2 | Blue tit <i>Parus caeruleus</i> | 20 |
| Wren <i>Troglodytes troglodytes</i> | 19 | Great tit <i>Parus major</i> | 14 |
| Robin <i>Erithacus rubecula</i> | 39 | Nuthatch <i>Sitta europaea</i> | 2 |
| Blackbird <i>Turdus merula</i> | 9 | Treecreeper <i>Certhia familiaris</i> | 2 |
| Song thrush <i>Turdus philomelos</i> | 2 | Jay <i>Garrulus glandarius</i> | 3 |
| Mistle thrush <i>Turdus viscivorus</i> | 1 | Magpie <i>Pica pica</i> | 2 |
| Blackcap <i>Sylvia atricapilla</i> | 5 | Carriion crow <i>Corvus corone</i> | 3 |
| Chiffchaff <i>Phylloscopus collybita</i> | 3 | Chaffinch <i>Fringilla coelebs</i> | 3 |

Woodpigeons *Columba palumbus* and starlings *Sturnus vulgaris* also nested but were not censused. Robins recovered to their 1991 level, but wrens and blue tits remained at the same low level as in 1992. Blackbird numbers continue to decline. Again there were no dunnoek *Prunella modularis* territories, and bullfinch *Pyrrhula pyrrhula* was absent. Blackcaps increased from their normal two or three territories to five, but coal tits and chaffinches decreased by similar amounts to only two territories each. Stock dove *Columba oenas* was disappointingly absent this year.

I spent very little time elsewhere on the Common and paid no visits outside the breeding season. Very few observations were passed on to me by other people. However, I did discover the other group of grey herons' *Ardea cinerea* nests in Central Wood. Three nests in each of the two groups appeared to have been successful, with at least two young in each.

There was an early cuckoo on 10 April and a number of them could be heard during the spring. There were at least three singing nightingales *Luscinia megarhynchos*, one quite close to the Tunnel car park, near to where the remarkable song of a wood warbler *Phylloscopus sibilatrix* could be heard at least from 30 April to 12 May. A stock dove sang in South-East Wood as in previous years, but no reports of turtle doves *Streptopelia decaocto* came my way. At last I managed to see a lesser spotted woodpecker *Dendrocopos minor*, a male alarm calling in South-East Wood on 17 June, whilst Brad Ashby had seen one near Bayfield Pond on 13 February, and about 50 redwings *Turdus iliacus* in the same area. A pair of sparrowhawks *Accipiter nisus* was displaying over Eastern Wood on 20 April, and there were other sightings there and over Central Plain. Robert Smith saw a hobby *Falco subbuteo* on 16 May. Someone I met at West Hollow Pond on 28 June had just seen a kingfisher *Alcedo atthis* there.

Coots *Fulica atra* nested on all four Hollow Path ponds and moorhens *Gallinula chloropus* probably did so there and on the Isle of Wight Pond, as they were present on all five ponds in the breeding season. Pairs of Canada geese *Branta canadensis* occurred on Upper Eastern and Eastern Hollow Ponds and they nested, apparently unsuccessfully, on Isle of Wight Pond. Fortunately I saw no mandarin ducks *Aix galericulata* this year.

The Common is one of the best sites in the London Area for nightingales and *Sylvia* warblers and there is much else of interest, yet it appears to be underwatched. There is a real need for someone to make regular observations here and help to continue the survey of bird life which the Society has been carrying out for many years.

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A survey of the aquatic macro-invertebrate communities of Isle of Wight Pond and Western Hollow Pond, Bookham Common

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Summary

The aquatic macro-invertebrate communities of the Isle of Wight Pond and the Western Hollow Pond at Bookham Common were surveyed in June 1993. Both ponds supported more than 40 taxa of macro-invertebrate, although the smaller pond supported more taxa than the larger water body. Analysis of community structure by Jaccard's Coefficient of Similarity indicates that the faunas were not dissimilar, although the coleopteran component of the two faunas was very different. The apparent similarity may have been an artefact caused by immigration of fauna via a feeder stream connecting the two ponds. It is suggested that the Isle of Wight Pond maintains a less diverse macro-invertebrate fauna than the Western Hollow Pond due to the presence of a high fish population and consequent lack of macrophytes.

Introduction

The macro-invertebrate communities in ponds within the London Area have received little attention by comprehensive survey (Biggs and Langley 1989). This deficiency is being remedied by some research groups (notably Pond Action, Oxford Brookes University). However, considerable work needs to be done in this field in order to elucidate the within-community interactions that influence the invertebrate populations of ponds.

The ponds of Bookham Common are exceptional because their fauna and flora have been the object of survey and study for many years. However, few surveys of the entire macro-invertebrate community in each pond have been carried out. With the aim of complementing the work already accomplished, a macro-invertebrate community survey of the Isle of Wight Pond and the Western Hollow Pond was carried out on 22 and 23 June 1993.

The Isle of Wight Pond (TQ126562) lies on a base of London Clay and is of irregular shape, covering approximately 0.34 hectares. The present shape was determined in the winter of 1972–3 when the pond was re-excavated due to encroaching scrub vegetation. An island was added at the same time to provide an area for birds (Beven and Radcliffe 1978). The pond is fairly shallow and the majority of the water basin is easily accessible with waders. From 1973 to 1975 the pond was dominated by broad-leaved pondweed *Potamogeton natans*, common water-crowfoot *Ranunculus peltatus* and blanketweed (algae). In the summer of 1976, however, almost no aquatic macrophytes grew within the pond except for small patches of *Myriophyllum* sp. and since that time macrophytes have been almost absent (Ashby 1991). A large population of stunted fish including bream *Abramis brama*, carp *Cyprinus carpio*, perch *Perca fluviatilis*, roach *Rutilus rutilus* and rudd *Scardinius erythrophthalmus* inhabit the pond and form the quarry of numerous anglers.

Western Hollow Pond (TQ127563) is also based on London Clay and is roughly rectangular in shape. It covers approximately 0.26 hectares and was excavated in 1977. In contrast to the Isle of Wight Pond, it is dominated by aquatic macrophytes, *Potamogeton* sp. and has several stands of emergent vegetation. Both ponds are surrounded by mixed deciduous woodland and have a proportion of their surface overhung by trees.

The ponds were surveyed in accordance with National Pond Survey techniques (Pond Action, Oxford Brookes University). The aims of the survey were to produce a species list of the macro-invertebrate fauna present within both ponds and to compare the differences between the fauna in the ponds in terms of the different environmental conditions. For the purposes of this study, the definition of a macro-invertebrate is one that is retained by a 1 mm mesh Freshwater Biological Association-pattern pond net.

Methods

A water sample from each pond was taken approximately 1 m from the shore and at a depth of 8.0 cm and was tested for pH and conductivity (in Micro-Siemens/cm) using Whatman micro-sensors. Water clarity and colour were assessed by eye. The occurrence and distribution of aquatic macrophytes in and around the two ponds were recorded so that distinct macro-invertebrate habitat zones could be identified (e.g. stands of emergent macrophytes and submerged macrophyte patches). Six habitat zones were distinguished in the Isle of Wight Pond (Table 1) and five zones in Western Hollow Pond (Table 2). Plants were identified using Clapham et al. (1981).

Macro-invertebrate samples were collected using a 1 mm mesh Freshwater Biological Association-pattern pond net during three minutes of concentrated hand netting. Sampling time was equally divided between each habitat zone within a pond (e.g. Isle of Wight Pond had six habitats, so each was sampled for 30 seconds). Two investigators worked in parallel so that two replicate samples were collected and combined from each habitat zone in each pond. Samples were partially sorted on site and were taken back to the laboratory for identification using specialized taxonomic keys.

TABLE 1. Macro-invertebrate taxa in Isle of Wight Pond.

| Taxa | Swamp | Salix | Iris | Juncus | Littoral | Logs |
|---------------------------------|-------|-------|------|--------|----------|------|
| TRICLADIDA | | | | | | |
| <i>Dugesia tigrina</i> | | × | × | | | |
| OLIGOCHAETA | | | | | | |
| <i>Aulodrilus pluriseta</i> | × | | | | | |
| <i>Stylaria lacustris</i> | × | | × | | | × |
| HIRUDINEA | | | | | | |
| <i>Helobdella stagnalis</i> | | | × | × | × | |
| <i>Hemiclepsis marginata</i> | | | | | | × |
| <i>Piscicola geometra</i> | | × | × | | | |
| MOLLUSCA | | | | | | |
| <i>Acroluxus lacustris</i> | | × | | | | |
| <i>Ancylus fluviatilis</i> | × | | | | | |
| <i>Physa fontinalis</i> | × | × | × | × | | × |
| <i>Pisidium</i> sp. | × | | | | | |
| <i>Planorbis vortex</i> | | | | | | × |
| <i>Potamopyrgus antipodarum</i> | × | | | | | |
| <i>Sphaerium corneum</i> | × | | | | | |
| ARACHNIDA | | | | | | |
| <i>Piona</i> sp. | × | × | | | | |
| Other mite sp. | × | | × | × | × | × |
| CRUSTACEA | | | | | | |
| <i>Argulus foliaceus</i> | × | × | | | | |
| <i>Asellus aquaticus</i> | | | | | | × |
| <i>Crangonyx pseudogracilis</i> | × | | × | × | | |
| INSECTA | | | | | | |
| Ephemeroptera | | | | | | |
| <i>Caenis robusta</i> | | × | | | | |
| <i>Cloeon simile</i> | | × | × | × | | |
| Megaloptera | | | | | | |
| <i>Sialis lutaria</i> | × | × | × | × | | |

| Taxa | Swamp | Salix | Iris | Juncus | Littoral | Logs |
|-------------------------------|-------|-------|------|--------|----------|------|
| Trichoptera | | | | | | |
| Limnephilidae larvae | | | | | | × |
| <i>Mystacides longicornis</i> | | × | × | × | × | |
| Odonata | | | | | | |
| <i>Aeshna mixta</i> | | × | | | | |
| <i>Coenagrion puella</i> | | | × | | | |
| <i>Ischnura elegans</i> | | × | | | | |
| Hemiptera | | | | | | |
| Corixidae nymphs | × | × | × | | | |
| <i>Gerris</i> sp. | × | | | × | | |
| <i>Ilyocoris cimicoides</i> | | × | | | | |
| <i>Micronecta scholtzi</i> | | | × | × | × | |
| <i>Nepa cinerea</i> | × | | | | | |
| <i>Notonecta</i> sp. | × | × | | × | | |
| <i>Sigara falleni</i> | | × | | | | |
| Coleoptera | | | | | | |
| <i>Anacaena limbata</i> | × | | | | | |
| Colymbetidae larvae | × | | | | | |
| Dytiscidae larvae | | | | × | | |
| <i>Helophorus brevipalpis</i> | × | | | | | |
| <i>Hydrochus nitidicollis</i> | × | | | | | |
| <i>Laccobius minutus</i> | × | | | | | |
| Diptera | | | | | | |
| Anopheles larvae | × | | | | | |
| Chironomidae larvae | × | × | × | × | × | × |
| Ptychoptera larvae | × | | | | | |
| Stratiomyidae larvae | × | | | | | |
| Total no. of taxa | 25 | 17 | 14 | 12 | 5 | 8 |

TABLE 2. Macro-invertebrate taxa in Western Hollow Pond

| Taxa | Submerged vegetation | Tree roots | Sparganium | Iris | Sediment |
|---------------------------------|-------------------------|---------------|------------|------|----------|
| TRICLADIDA | | | | | |
| <i>Polycelis tenuis</i> | | | | × | |
| OLIGOCHAETA | | | | | |
| <i>Stylaria lacustris</i> | × | | | | |
| HIRUDINEA | | | | | |
| <i>Erpobdella octoculata</i> | | × | × | × | |
| <i>Glossiphonia heteroclita</i> | × | × | | | |
| <i>Helobdella stagnalis</i> | | × | | | |
| <i>Hemiclepsis marginata</i> | | × | | | × |
| <i>Piscicola geometra</i> | × | | | | |
| <i>Theromyzon tessulatum</i> | | | | × | |
| MOLLUSCA | | | | | |
| <i>Acroluxus lacustris</i> | × | | × | | |
| <i>Lymnaea auricularia</i> | | | | × | |
| <i>Lymnaea peregra</i> | | | × | × | |
| <i>Lymnaea palustris</i> | | | | × | |
| <i>Physa fontinalis</i> | × | | | | |
| <i>Pisidium</i> sp. | | × | × | | |
| <i>Planorbis albus</i> | × | × | × | × | |
| <i>Planorbis vortex</i> | × | × | × | × | × |
| <i>Segmentina complanata</i> | | | | × | |
| <i>Sphaerium corneum</i> | | × | × | | × |
| CRUSTACEA | | | | | |
| <i>Asellus aquaticus</i> | × | × | × | × | × |
| <i>Crangonyx pseudogracilis</i> | × | × | × | × | × |
| INSECTA | | | | | |
| Ephemeroptera | | | | | |
| <i>Caenis robusta</i> | × | × | × | × | × |
| <i>Cloeon dipterum</i> | × | × | × | × | × |

| Taxa | Submerged vegetation | Tree roots | Sparganium | Iris | Sediment |
|-----------------------------|-------------------------|---------------|------------|------|----------|
| <i>Cloeon simile</i> | × | | | × | |
| Megaloptera | | | | | |
| <i>Sialis lutaria</i> | | | × | × | × |
| Trichoptera | | | | | |
| <i>Athripsodes cinereus</i> | | | × | | |
| Odonata | | | | | |
| <i>Aeshna cyanea</i> | | | | | × |
| <i>Aeshna mixta</i> | × | × | | | |
| <i>Coenagrion puella</i> | × | × | × | | |
| Hemiptera | | | | | |
| Corixidae nymphs | | | | × | |
| <i>Callicorixa praestra</i> | × | | | | |
| <i>Corixa punctata</i> | × | | | | |
| <i>Gerris</i> sp. | | × | | | |
| <i>Hydrometra stagnalis</i> | | × | | | |
| <i>Ilyocoris cimicoides</i> | × | | | × | |
| <i>Nepa cinerea</i> | | | | × | |
| <i>Notonecta</i> sp. | × | × | × | × | × |
| <i>Plea leachi</i> | × | | | | |
| <i>Sigara dorsalis</i> | | | × | | |
| <i>Sigara falleni</i> | × | | | | × |
| <i>Sigara fossarum</i> | | × | | | |
| Coleoptera | | | | | |
| <i>Agabus sturmii</i> | | | | × | |
| Dytiscidae larvae | × | × | × | × | × |
| <i>Haliphus ruficollis</i> | × | | × | | |
| <i>Hydroporus palustris</i> | | | | × | |
| <i>Hygrotus inaequalis</i> | | | × | | |
| <i>Noterus clavicornis</i> | | | | × | |
| Diptera | | | | | |
| <i>Anopheles</i> larvae | | × | × | × | |
| Ceratopogonidae larvae | | | | × | |
| <i>Chaeborus</i> sp. | × | × | × | × | × |
| Chironomidae larvae | × | × | × | × | × |
| Total no. of taxa | 24 | 22 | 22 | 27 | 14 |

TABLE 3. Calculations of Jaccard's Coefficient for Isle of Wight Pond and Western Hollow Pond.

Jaccard's Coefficient of Similarity =

$$\frac{\text{Number of taxa common to both sites}}{(\text{number of taxa at site A} + \text{number of taxa at site B}) - (\text{number of taxa common to both sites})}$$
$$= \frac{25}{(43 + 50) - (25)} = 0.368$$

Results and discussion

Water chemistry

The water in the Western Hollow Pond (pH 8.3) was more alkaline than the water in the Isle of Wight Pond (pH 7.0). Water conductivity was similar in both ponds, being 340 μ S/cm in Isle of Wight Pond and 380 μ S/cm in Western Hollow Pond. The water of the Isle of Wight Pond was noticeably more turbid than that of Western Hollow due to suspended clay particles as reported by Ashby (1991).

Aquatic and bankside vegetation

At the time of sampling, a large proportion of the Isle of Wight Pond margin was overhung by common sallow *Salix cinerea*. Other portions were edged, and in places overhung, by a variety of other deciduous trees including oak *Quercus* spp. and birch

Betula spp. Small stands of emergents were present on and adjacent to the littoral margins, mainly yellow flag iris *Iris pseudacorus* and soft rush *Juncus effusus*. The pond was almost devoid of macrophytes, although there was a large area of sallow carr at the eastern end and an area of diverse wetland vegetation at the point at which the feeder stream enters the pond. The major species represented in this area of wetland at the time of sampling were: water plantain *Alisma plantago-aquatica*, remote sedge *Carex remota*, great willowherb *Epilobium hirsutum*, water horsetail *Equisetum fluviatile*, Yorkshire fog *Holcus lanatus*, *J. effusus*, purple loosestrife *Lythrum salicaria*, water mint *Mentha aquatica*, water forget-me-not *Myosotis scorpioides*, creeping buttercup *Ranunculus repens*, red-veined dock *Rumex sanguineus*, woody nightshade *Solanum dulcamara*, and bur-reed *Sparganium erectum*. A few scattered oak and sallow saplings grew amongst these plants.

Western Hollow Pond, in contrast, had prolific aquatic macrophyte growth. Most of the area of the pond had a thick growth of *Potamogeton* sp. that extended from just below the surface (with some stems projecting slightly above) to a depth of over 30 cm. Several stands of emergents including *Sparganium erectum* and *Iris pseudacorus* grew at the margin of the pond. The banks were covered in mixed herbage and much of the margin was overhung by a variety of deciduous trees. A fallen, semi-submerged tree was present at the eastern end of the pond. Most of the benthic substrate in Western Hollow Pond was composed of mud with a high organic content including semi-decomposed leaf litter, in contrast to the sand and gravel substrate of the Isle of Wight Pond.

Macro-invertebrate communities

The Isle of Wight Pond sample contained a total of 43 taxa (Table 1). The Western Hollow Pond sample contained a total of 50 taxa (Table 2). Initially, these values do not appear to indicate a significant difference in taxonomic diversity. However, if the numbers of taxa found in each habitat zone are examined, it can be seen that the swamp sub-sample from the Isle of Wight Pond contained a disproportionate number of the total found in the whole sample. Nearly 60 per cent (25 out of 43) of the taxa found in the Isle of Wight Pond were found in the swamp, whereas the next most diverse habitat, the *Salix*, contained only 17 taxa (less than 40 per cent). A mean of 13.5 taxa/habitat zone (variance = 49.9) was found in the Isle of Wight Pond, whereas a mean of 21.8 taxa/habitat zone (variance = 23.2) was found in the Western Hollow Pond. The high variance shown by the Isle of Wight data illustrates the lack of homogeneity of the number of taxa/habitat. The lower variance of the Western Hollow data mean reflects a greater similarity of taxa/habitat in this pond.

A Jaccard's Coefficient of Similarity calculation (Table 3) based on the number of different taxa that they have in common in relation to the number discovered overall, shows a similarity of 0.368. This analysis indicates that the faunas of the two ponds are not dissimilar. However, it is considered rare for two adjacent ponds to have more than 50 per cent of their fauna in common (Friday 1987). In fact, the calculation of similarity may not reflect the true comparative index, as it must be noted that 48 per cent of the taxa present in the swamp habitat sub-sample from the Isle of Wight Pond are also found in the Western Hollow Pond. The swamp receives water from a small stream connecting the two ponds and forms a refuge for macro-invertebrates from fish predation prevalent in the rest of the pond. As a consequence, the faunal components of the swamp habitat may be influenced by immigration from Western Hollow Pond.

The taxon which varies most between the two ponds is the Coleoptera since the ponds had no adult beetle species in common. Waterbeetles are amphibious (Friday 1988) and are thus able to demonstrate their environmental preferences more easily than more-sedentary species. Perhaps the difference in the coleopteran fauna of the two ponds gives a true idea of the different environmental conditions present in each water body.

The survey shows that, in spite of its larger size, the Isle of Wight Pond had a more depauperate macro-invertebrate fauna than Western Hollow Pond. There are several

factors which may account for this. The Isle of Wight Pond has a substantial fish population. The population density is high enough to cause stunting (Beven and Radcliffe 1978, Beven 1979) as a response to competition for resources in the waterbody. Under these conditions of high population density and competitive stress, the chances of macrophyte re-establishment in the pond are low. The cyprinid species within the pond are facultative herbivores (Prejs 1984) capable of eating submerged macrophytes (Lammens and Hoogenboezem 1991, Lodge 1991). The carp, crucian carp and bream, especially, are grubbers in the benthic substrate and will uproot or dislodge any macrophytes (Welcomme 1984). In addition, the turbidity of the water in the Isle of Wight Pond, possibly the result of fish-grubbing activity, will tend to discourage the development of any submerged photosynthetic organism. Invertebrate diversity and abundance within a waterbody are usually correlated very strongly with the abundance of submerged macrophytes present (Dvorak and Best 1982). The absence of macrophytes within the Isle of Wight Pond means that there is little in the way of the cover, feeding substrate or attachment sites necessary for many species of macro-invertebrates to thrive. The dense fish population ensures that the predation pressure on the macro-invertebrate population is very high, limiting the potential for both colonization and persistence of prey species.

Conclusions

Surveys and comparisons of the macro-invertebrate faunas of ponds may be used to give a general idea of how similar they are in habitat. In this study two adjacent ponds with similar water and geology were surveyed and found to support dissimilar macro-invertebrate faunas. It is possible that the differences in macro-invertebrate diversity between the two ponds are due to the differential macrophyte cover within each. This may be a consequence of the present high fish population in the Isle of Wight Pond.

Acknowledgements

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Observations on the lack of macrophytes in the Isle of Wight Pond, Bookham Common

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Summary

The factors likely to be responsible for the failure of macrophyte recolonization in the Isle of Wight Pond are discussed. The synchronous recruitment and competitive interactions of several year classes of cyprinid fish are postulated as probable major factors contributing to the continued absence of macrophytes. A means by which the hypothesis can be tested and by which macrophytes might be re-established is suggested.

Introduction

The history, fauna and flora of the Isle of Wight Pond have been fully documented in previous articles (Bookham Common Survey Reports in *The London Naturalist*). In the past the pond has had a period of extensive macrophyte cover followed by a sudden cessation of growth. This may have been the result of a combination of factors. It is interesting to speculate on the sequence of interactions that may have led to the present lack of macrophytes in the Isle of Wight Pond. It is possible that the following hypothesis may contain some of the essential elements of what occurred.

Discussion

Several biotic and abiotic factors within the Isle of Wight Pond would have changed significantly as a result of re-excavation in the winter of 1972–3. The pond area and volume were significantly increased and much of the benthic sediment was removed (Beven and Radcliffe 1978). Because of the disturbance caused by excavation, the water would have had a nutrient loading significantly higher than usual. The fish population, whether introduced or recolonizing from a restricted remnant of an initial population, would have had a far greater water volume per fish to utilize than before the re-excavation. This combination of factors gave rise to several effects. The high nutrient load and low levels of fish disturbance and herbivory permitted profuse macrophyte growth. This attracted and supported a diverse and abundant community of invertebrates. The presence of profuse macrophytes as spawning substrate, food and cover would also have encouraged successful spawning in the fish population. In addition, an abundant supply of prey items (rotifers and small zooplankters) suitable for fish fry and juveniles, and thick cover from the macrophytes would ensure a high level of recruitment (Rozas and Odum 1988). This would have been further enhanced by the low levels or absence of predatory vertebrates.

The next year the still relatively small adult fish community would be in excellent condition from an abundance of food and limited intra- and interspecific competition and therefore they would breed successfully again. The fry would have an abundance of food since the previous year's fry would have grown and thus become capable of exploiting macro-invertebrate prey. This diet switch of the previous year's fry would have helped minimize inter-year class competition for food.

Most perch *Perca fluviatilis* present in the pond were still too small to consume fry. Therefore the rate of recruitment would be high. Van Donk et al. (1990) observed similar high recruitment success in a rudd *Scardinius erythrophthalmus* population spawning in the near-absence of pike *Esox lucius* predation. Consequently, the conditions were optimal for an explosive growth of the fish population, supported by the strong differences in resource requirements of the different year-classes of fish.

This growth of the fish population may have continued for another year, or possibly 1975 was the first year when conditions in the fish community changed radically. The

fry and juveniles from the spawnings of the previous two or three years reached maturity and their dietary and resource requirements changed. Macrophytes and substrate-dwelling organisms were exploited by these newly-matured fish. Until this time the adult population had been low and the effects of their foraging were limited. Now, however, there was an enormous increase in the inter- and intraspecific competition for macrophyte-dwelling macro-invertebrates.

In addition, the advent of a sudden, massive increase in substrate-grubbing by adult cyprinids, in strong competition for macrophyte- and substrate-dwelling macro-invertebrates, led to an increase in the stress on the macrophytes. Cyprinids cannot normally root beyond a certain sediment depth (varying with species) (Lammens et al. 1985, Lammens and Hoogenboezem 1991). Deep sediments, therefore, help protect the rootstocks of macrophytes from fish disturbance and mechanical damage. The lack of mud in the Isle of Wight Pond ensured that the rootstocks of the macrophytes were vulnerable to disturbance and mechanical damage caused by cyprinid rooting. It is probable that in the conditions of increased competition for food, the macrophyte also began to play a role as a source of grazed food. Both Lodge (1991) and Prejs (1984) note the role of mature cyprinids as herbivores on freshwater macrophytes.

During the next year, the mature fish population density increased again as the large number of recruited fry from the second spawning matured. This intensified the competition for food and the amount of foraging necessary for a fish to fulfil its resource requirements, and resulted in additional stress on the macrophytes. By the next year, the constant activity of the overcrowded fish precluded macrophyte growth. Similar effects have been observed in carp *Cyprinus carpio* populations by Welcomme (1984).

The ability of fish to stunt enables them to maintain their high population numbers in the Isle of Wight Pond by not growing. Any increase in resources will be exploited by faster growth of individuals or an increase in spawning and recruitment success. Any slack in the system that might normally allow macrophytes to re-establish is instantly taken up by the fish. Similarly, a reduction in fish numbers, such as the fish removal performed in 1978 (Beven 1979), will result in faster individual growth and greater spawning success until competitive pressure inhibits population growth unless a significant proportion of the whole fish population is removed. The dense fish population precludes any increase in the abundance or diversity in the macro-invertebrate populations, other than those of fish parasites, e.g. the fish louse *Argulus foliaceus*.

At present this hypothesis is purely speculative and is based on observation, survey (Kett and Kirk 1994) and information from previous studies (Bookham Common Survey Reports in *The London Naturalist*). It may be possible to gain more evidence about the role of the fish population within the pond by scale reading. If suitable scales are obtained from the oldest of the fish within the pond (carp would be suitable for this purpose) it may be possible to find which were years of good fish growth and whether those years correspond to the proposed mechanism of macrophytes loss.

It must be noted, however, that by comparison, the Western Hollow Pond has very different conditions, although based on the same clay and fed with the same water as the Isle of Wight Pond. When surveyed in 1993 the Western Hollow Pond had a dense submerged aquatic macrophyte community including *Potamogeton* sp. and extensive stands of littoral emergents, *Iris pseudacorus* and *Sparganium erectum*. It has a substrate comprising largely organic mud and debris rather than sand, clay and gravel, and has a substantially smaller fish population than the Isle of Wight Pond. Observation and sampling failed to show any evidence of fish within the Western Hollow Pond other than tench *Tinca tinca* fry.

Experimentation and active management

Beven and Radcliffe (1978) wrote that it is unusual for large bodies of shallow water to remain without aquatic vegetation and they expected that recolonization of the Isle

of Wight Pond with macrophytes would occur in due course. Fifteen years have failed to produce the expected macrophytes and the author suggests that, if their presence in the Isle of Wight Pond is desired, active management must be undertaken in order to promote their successful colonization and spread.

Exclosures may prove to be a means of experimenting with macrophyte re-introduction to the pond. These should be constructed of chicken wire or similar, with a mesh of approximately 1.00 cm. This is sufficient for the free passage of water and invertebrates, but will prevent the entrance of fish. The exclosures should be as large as is economically expedient, a minimum of 1.00×1.00 m, and situated in the littoral zone. A variety of macrophytes could be stocked within the exclosures, either monospecifically or in mixed-species assemblages. Different rooting substrates could be provided. Their growth should be monitored, together with their success in establishing roots in the different substrates.

If the experiment proves successful and the exclusion of fish renders the recolonization of the pond with macrophytes possible, it may be feasible to proceed by two means. Either a massive cull of all the fish species within the pond, followed by the wholesale planting of macrophytes, or the establishment of 'fish-free' zones by extending the exclosure principle. In either case it would probably be necessary to carry on removing fish, either from the pond as a whole or merely the maturing fry that slip through mesh into exclosures, by electrofishing or similar means. The build-up of organic matter to protect the rootstocks of the plants could be encouraged by the addition of straw bales or similar into the pond.

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Book review

Mushrooms & fungi. Geoffrey Kibby. 'Junior Nature Guides' series edited by Leslie Jackman. Dragon's World Children's Books, Limpsfield and London. 1994. 81 pp., profusely illustrated in colour. £7.95. ISBN 1 85028 239 0.

In 1992, Dragon's World published an ambitious series of large-format illustrated books on various natural history subjects, two of which were reviewed in *The London Naturalist* No. 72 (1993). At the same time, abridged versions in smaller format were published as pocket guides. They are now to be congratulated on launching a series of Junior Nature Guides, *Fossils*, *Mammals*, *Insects*, *Mushrooms & fungi*, aimed at 8 to 12 year olds with simplified text based on the larger works. *Mushrooms & fungi* reproduces some 190 of Geoffrey Kibby's illustrations, to which are added six appealing habitat paintings by Michael Saunders. My first impressions of the book were clouded by the strange mixture of simple language and scientific terms, by the annoying use of the plural 'fungi' instead of 'fungus' ('A fungi hunt', 'A fungi expert', 'Fungi smell', etc.) and by too many printers' errors which should have been spotted. The remains of the universal veil at the base of the fly agaric illustrated on page 6 is labelled, 'vulva', an error for, 'volva'. On page 20, the illustrations of *Tricholoma fulvum* and *Leccinum holopus* have been reversed, each appearing with the text of the other species. The dust-jacket says, 'This book will show you the fungi you are most likely to find...', but several distinctly rare species are included, whilst a number of very common species are left out.

The book is arranged in six sections based on habitat, each of which begins with one of Michael Saunders' beautiful paintings, which include a dozen or more toadstools. The young reader is asked, 'How many can you identify?'. It would have been kinder and more useful to say, 'When you have read through the following section, come back to the picture and see how many you can name.' The Latin names are printed upside down at the foot of the page, but in one case (Conifer Woods) they have been printed right way up! I would have preferred these to have been put at the end of the book and with a key to their location in the picture. (My score was something less than 100 per cent!)

But these are a grown-up's grumbles. The intended readership would not be bothered by them and I know I would have been over the moon if I had received this book as a gift when I was an 8 to 12 year old. A feature which makes this series of books different from most others is the inclusion of pages suggesting up to 20 activities for budding naturalists. Young mycologists are told how to keep simple note-books, how to make spore-prints, to make models and how to display their finds. Warnings and cautions about obtaining permission before collecting, avoiding damaging habitats, avoiding poisonous species, washing hands after handling toadstools and so on are stressed, so that parents should be able to enjoy some occasional peace and quiet, content in the knowledge that their youngsters are safely and usefully occupied.

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The tardigrade fauna of Bookham Common

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Summary

A total of 57 epiphytic moss, lichen and leaf-litter samples from Bookham Common was examined during 1992 and 1993 for tardigrades. Twelve tardigrade species were identified representing eight genera, including six species which have not been recorded elsewhere in Surrey. Faunistic notes are given on the species identified and the possible factors limiting tardigrade species diversity in south-east England are discussed.

Introduction

A number of studies of tardigrade distribution have been made in the British Isles on both local and national levels which have extended the knowledge of the distribution of this micro-invertebrate phylum. However, considerably more thorough studies have been performed in some European countries and undoubtedly much remains to be learnt of the distribution and diversity of tardigrade species in Britain. Records for the south-east of England in particular are very limited with only five published accounts of species found in the region (Mitchell 1982, Kinchin 1989, Greaves 1991, Ashby 1992, Bertolani and Kinchin 1994). As a consequence, this region appears to have a relatively restricted tardigrade fauna. However, in this region, like many in Britain, no studies of intensive sampling in a restricted area have been published.

It is a measure of the limited literature on British tardigrades that three collecting visits to Bookham Common in 1992 and 1993 now result in this area being one of the most intensively studied single sites for tardigrades in England. Surveys of the bryophyte flora of Bookham Common (Stern and French 1983, French 1991) have commented on the relatively limited variety of species recorded. Although moss is undoubtedly the preferred habitat for most terrestrial tardigrades, a surprising species diversity has been found at the Common when compared to previous reports on the fauna of south-east England.

A progress report of the tardigrades found during the first year of collecting at Bookham has previously been published (Greaves 1993); the present paper summarizes the results of both years' collecting at Bookham, including the results recorded in the initial progress report.

Sampling methods

During 1992 and 1993 a collection of samples, predominantly of epiphytic moss, but also including lichen, liverwort and leaf-litter, were removed from Bookham Common. Tardigrades were extracted by either washing in tap water (NJM) or by sieving onto 45 μm mesh (PMG) and the species found examined by light microscopy in both the living state and mounted in either Andre's medium or Heinz's polyvinyl alcohol. Identification of species has been based initially on the key of Morgan and King (1976) with recourse to the keys of Ramazzotti and Maucci (1983) or primary literature where necessary. Mounted slides from the survey are maintained in the collections of the authors.

No attempt has been made systematically to sample all the survey areas of Bookham Common or to collect all materials with which tardigrades may be associated. This survey can only be regarded as preliminary; considerably more samples would be

required before an analysis of the species distribution of tardigrades on the Common could be made.

Systematic account

The following systematic account of the species found at Bookham is divided into those species that have been recorded in Surrey prior to the survey at Bookham (Greaves 1991, Ashby 1992) and those species which have only been recorded for the county during the two-year survey.

Species recorded from other locations in Surrey

Macrobiotus hufelandi group

Macrobiotus hufelandi is a cosmopolitan species and is perhaps the most commonly encountered tardigrade in moss. However, at Bookham this species was only found infrequently on epiphytic moss. The species has previously been widely recorded in Surrey (Greaves 1991). Its distribution at Bookham is probably limited by the range of moss species, *Macrobiotus hufelandi* being more frequently encountered in mosses such as *Bryum* and *Ceratodon* species, which were not commonly found during this survey.

The diverse morphologies shown by tardigrades conforming to the original description of *Macrobiotus hufelandi* has resulted in the species being divided into over a dozen distinct species (Biserov 1990a, b, Bertolani and Rebecchi 1993). No attempt has been made during the study at Bookham specifically to identify species of the *M. hufelandi* group as many of the specimens were collected prior to Bertolani and Rebecchi's revision, and eggs, which were not encountered, are required for final speciation within the group. It is likely however, that some of the new species described by Biserov and Bertolani and Rebecchi are present at Bookham.

Macrobiotus harmsworthi group

Individuals conforming to the description of the *Macrobiotus harmsworthi* group were isolated from both epiphytic and free-growing moss, with a frequency similar to that seen for *M. hufelandi* group. As with many of the Macrobiotidae, speciation within the group has not been possible due to the lack of eggs. Again, this group has been widely encountered in Surrey.

Dactylobiotus dispar

This species was recorded by Ashby (1992) from one of the ponds on the Common. As eggs were not found by Ashby, it is difficult to be certain which species within the *ambiguus/dispar/macronyx* group was found. Future work at the Common will concentrate on locating eggs to determine which species is present at Bookham.

Echiniscus testudo

The variety *trifilis* of *Echiniscus testudo* was found in a single sample of an orange *Xanthoria* species lichen which had fallen off the roof of the warden's house. Although not strictly part of the natural environment of Bookham Common, this was the only heterotardigrade found at Bookham.

Hypsibius arcticus

A single specimen of *Hypsibius arcticus* was found in an epiphytic moss on a willow tree in Bay Pond. This species is cosmopolitan and has been recorded in many lowland counties (Morgan and King 1976). Its absence in other mosses collected at Bookham is hard to explain and further sampling will be required to determine if the species is genuinely restricted at Bookham or has merely been missed in the present study.

Diphascon (Adropion) scoticum

Diphascon (Adropion) scoticum was encountered frequently in both epiphytic and free-growing mosses and was present in both leaf-litter samples taken during the study. One of the litter samples consisted of submerged bracken leaf-litter from the edge of Sheep Bell Pond. *Diphascon (Adropion) scoticum* is not generally considered to be an aquatic species and has not been seen by either author in such a location before. However, the species is encountered frequently in leaf-litter and the presence of individuals in the sample from Sheep Bell Pond may be due to a possible rise in the water level caused by rain prior to the sampling.

Milnesium tardigradum

This widely distributed species was found in a number of moss samples taken from the Common. Both non-pigmented and chestnut-pigmented individuals, with the pigment arranged in bands, were observed. The species is carnivorous and is generally found in association with other tardigrades which may serve as a food source. However, in one moss sample taken from Bookham Common, the species was found in the absence of other tardigrades, confirming observations made by Kinchin (1990) of this species in lichen from Northern Ireland.

Species not previously recorded at other sites in Surrey***Macrobiotus richtersi***

This species was encountered relatively frequently at Bookham Common in damp mosses. It has not been recorded from other locations in Surrey, but this may be due to difficulties in identifying beyond the *harmsworthi* group level in the absence of eggs. However, *M. richtersi* has rod-shaped macroplacoids as opposed to granular placoids in *M. harmsworthi* and also has a microplacoid (absent in *M. aereolatus*). *M. richtersi* was recorded by Mitchell (1982) from Brenchley, Kent.

Minibiotus intermedius

Minibiotus intermedius (previously *Macrobiotus intermedius*) was found frequently at Bookham and was the most abundant species isolated by one author (NJM). Eggs were also extracted, which have not previously been seen by either author. Although described as cosmopolitan by Morgan and King (1976), there have been few previous published reports of *Minibiotus intermedius* in Britain. Murray (1905, 1906) recorded the species at a number of sites in Scotland and Le Gros (1956) found the species at a single site in Shropshire.

Isohypsibius prosostomus

Found in moss from the brick edging at Lower Eastern Pond, this species has been widely recorded in the British Isles, but has not been encountered previously in Surrey. Specimens of *Isohypsibius schaudinni*, recorded in the 1992 Progress Report (Greaves 1993) have now been reidentified as *Isohypsibius prosostomus*.

Diphascon (Diphascon) pingue

Diphascon (Diphascon) pingue has a widespread distribution worldwide (McInnes 1994). A number of specimens were found at Bookham, both in mosses in damp locations and also in drier moss on a felled oak trunk at Western Hollow. Although not an addition to the fauna of the British Isles, this species has been recorded at only one other site, Co. Wicklow (Mitchell 1973).

Diphascon (Adropion) prorsirostre

This species was found in limited numbers in damp mosses. It can be differentiated from *D. (D.) pingue* and *D. (A.) scoticum* by the lack of a microplacoid. In addition, *D. (D.) pingue* possesses a septulum and the buccopharyngeal tube has a drop-shaped

structure, and *D. (A.) scoticum* has additional cuticular bars around the base of the claws. It has been found at only one other location in England (Baxter 1982).

Itaquascon sp.

Tardigrades of an *Itaquascon* species were found relatively widespread at Bookham. Although there have been no published reports of this genus in the British Isles, this same species has been found in other British locations by one author (NJM) and will be described fully (Marley and Wright in prep.).

Checklist of the Bookham Common tardigrade fauna

Systematics follow Ramazzotti and Maucci (1983), except for more recent revisions where applicable.

Echiniscus testudo var. *trifilis* (Doyere, 1840)

Milnesium tardigradum Doyere, 1840

Macrobiotus hufelandi group

Macrobiotus harmsworthi group

Macrobiotus richtersi Murray, 1911

Minibiotus intermedius (Plate, 1888)

Hypsibius arcticus (Murray, 1907)

Isohypsibius prosostomus Thulin, 1928

Diphascon (Diphascon) pingue (Marcus, 1936)

Diphascon (Adropion) prorsirostre Thuin, 1928

Diphascon (Adropion) scoticum Murray, 1905

Itaquascon sp.

Dactylobiotus dispar (Murray, 1907), reported by Ashby (1992).

Discussion

Prior to this survey, a total of 14 species of tardigrade had been recorded for the county of Surrey. From reports of the bryophyte flora at Bookham Common (Stern and French 1983, French 1991), which comment on the limited number of moss species present, it could be assumed that a survey of the tardigrades at Bookham would not add significantly to the number of species known to occur in Surrey. However, the survey reported here has recorded six species new to the county (including the species described in the survey progress report, Greaves 1993), representing a 43 per cent increase in the number recorded for Surrey.

The diversity of species found at Bookham Common compared to the rest of the county requires comment. Factors affecting the distribution of tardigrades are only poorly understood. Attempts to correlate the species of tardigrade with the species of the moss have not shown any significant correlation (e.g. Nelson 1975), but altitude, humidity and rainfall have all been shown to affect both the diversity of species and density of tardigrades found.

Ramazzotti and Maucci (1983) grouped tardigrade species according to four moss types; xerophiles (present only in mosses subject to frequent desiccation), euritopes (present in all moss types), idrophiles (present in submerged mosses) and igrophiles (present in humid mosses). On this basis, two of the species found at Bookham, *Echiniscus testudo* and *Milnesium tardigradum* are xerophilic. The single record of *E. testudo* was made in a lichen subject to desiccation (the roof of the warden's house), but *M. tardigradum* was found in a wider range of mosses. All the *Macrobiotus* species

and *Isohypsibius prosostomus* are euritopes. The most frequently encountered tardigrades at Bookham, *Minibiotus intermedius* and the *Diphascon* species, are all classified by Ramazzotti and Maucci as igrophilic. Although Bookham Common is a relatively dry area and could therefore be expected to have few igrophilic mosses, shade will increase the humidity level of the moss micro-environment by protecting from direct sunlight. The high density of mature oaks at Bookham affords a significant degree of shading and may be a critical factor in the relative density and diversity of igrophilic tardigrades found there. The presence of *Minibiotus intermedius* in these shade areas compares well with the findings of Meininger et al. (1985) who reported it as preferring rural, humid sites and being apparently intolerant of fast evaporation rates which may occur in more xeric environments. *Dactylobiotus dispar* (Murray), the only idrophilic species of tardigrade reported from Bookham (Ashby 1992), may occur in many of the ponds on the Common. The ponds' meiofauna has been monitored for many years, but the preferred sampling methods have favoured planktonic and pelagic organisms and not the benthic or algaephilic tardigrades, thus possibly explaining its absence from previous reports.

More recently, Dastych (1988) has correlated tardigrade species with the kind of bedrock, differentiating between calciferous and non-carbonate rocks. Dastych divided the species found in Poland into five groups: eucalciphilous (found exclusively on carbonate and alkaline rocks), polycalciphilous (very strong, but not exclusive attachment to carbonate rocks), mesocalciphilous (associated with both carbonate and non-carbonate rocks), oligocalciphilous (strongly, but not exclusively attached to non-carbonate rocks) and acalciphilous species (found exclusively on non-carbonate rocks). Of the species classified by Dastych that have been found at Bookham, the majority are mesocalciphilous or oligocalciphilous, correlating well with the slightly acidic London Clay bed on which Bookham Common sits. Two species found at the Common, however, are classified by Dastych as eucalciphilous (*Echiniscus testudo*) and polycalciphilous (*Macrobiotus richtersi*), and should not normally be expected at Bookham. The presence of *E. testudo* can probably be explained by the presence of lime in the roof tiles or mortar of the warden's house where this species was found. The presence of *M. richtersi* may be due to a local modification of the soil type.

Although no definite conclusions can be drawn, this survey does help to allow some generalizations regarding the tardigrades of south-east England. In particular, this study and that conducted for Surrey as a whole (Greaves 1991) show that heterotardigrades are largely absent from the region, *Echiniscus testudo* being the only species reported. Conversely, *Diphascon* species in particular are common in the region, possibly due to the degree of shading by trees in many areas. However, overall sampling biases cannot be ruled out and more data from sites in the south and east of England are required.

The diversity of tardigrades found at Bookham, when compared to south-east England as a whole, may be due to biotic factors (such as moss type, prey species available) or abiotic factors (such as climate or bed rock). However, Bookham Common does not appear to offer a habitat that is unique in the region and it is more likely that the species diversity is purely as a result of the intensity of sampling on the Common for this survey. More work is required at other sites in the region before conclusions can be drawn regarding the apparent species diversity at Bookham. More work at Bookham Common in particular, on both moss fauna and other materials such as leaf-litter, will undoubtedly extend the tardigrade species reported here.

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Botanical records for 1993

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Summary

The most interesting plant records from the London Area in 1993 are presented, continuing an annual sequence of papers. They include the first Essex record of *Stachys annua*, the first Middlesex record of *Egeria densa*, and the second Middlesex record, after an interval of 78 years, of *Oenanthe pimpinelloides*. The local distribution of the last-named species is reviewed.

Introduction

As in previous years, selected records of flowering plants from the area within 32 km (20 miles) of St Paul's Cathedral are presented in the sequence Kent, Surrey, Essex, Hertfordshire, Middlesex, Buckinghamshire, the counties being separated according to the boundaries as they were following the creation of the first county of London. The reason for adopting this arrangement is explained in another paper in this issue of *The London Naturalist* (Burton 1994). Within each county, records from localities within the present boundaries of London boroughs are presented before those from the modern counties. No Buckinghamshire records are included in this report.

Kent

Also as in previous years, the activities of the London Ecology Unit will often need to be mentioned. In January 1994 the LEU distributed a schedule of sites of nature conservation interest in the Borough of Lewisham, which drew attention to the large population of twiggly mullein *Verbascum virgatum* in the railside vegetation beside Hither Green Cemetery discovered in 1993 by Mike Prime, and the substantial colony of tor-grass *Brachypodium pinnatum* on a nearby nature reserve. I do not know if the Blackheath sites where two unusual plants were recorded in 1993 are in this borough or in Greenwich. Ken White found button-weed *Cotula coronopifolia* in a pond, which like other ponds in such urban sites is generally of little attraction to naturalists, because of the hard banks and frequent disturbance, so perhaps it is most likely that the marginal weed was introduced in the course of pond restoration works. *Aethionema saxatile* is a small rock-garden plant found by John Palmer as a pavement weed, and identified for him by Eric Clement. One other London site for which I have records from Mr Palmer is the 'enormous gravelly wasteland' of Crayford Marshes. The plants he lists from here, including a *Yucca* sp., a popular garden shrub *Lavatera olbia*, leguminous plants such as soft clover *Trifolium striatum* and yellow vetch *Vicia lutea*, indicate a very different flora from the plants we could find here in the early 1970s when this was one of many tips around the eastern fringe of London.

My usual difficulty with Mr Palmer's records from Kent is in selecting for publication those which I think are most likely to be of interest. These are in date order of discovery, starting in December 1992 with the winter-flowering Glastonbury thorn *Crataegus monogyna* var. *biflora* in a field hedge at Horton Kirby, and proceeding to summer-flowering plants by way of *Forsythia suspensa* var. *pallida* on a steep wooded bank at South Darenth, where it had to be seen in flower to be noticed at all as something obviously different from the common garden plant *F. × intermedia*. On dry ground at Ebbsfleet and Sutton-at-Hone he found a curious dry-ground form of the yellow flag *Iris pseudacorus* for which a varietal name would be appropriate though we do not know one; as well as being much smaller in all parts, perhaps a result of drought, it is also distinguished by much deeper yellow coloration on the haft of the falls. Like him I have explored Broom Hill, Swanley which is close to the M25 Motorway and looks as though it might be interesting, and found such plants as the clovers *Trifolium striatum* and *T. arvense*, but I never noticed the compact brome *Anisantha madritensis*. Along the edges of maize fields between Springhead and

Northfleet he found thousands of plants of *Phacelia tanacetifolia*; these were presumably sown, but for what purpose? With Eric Philp and Geoffrey Kitchener, Mr Palmer went on 1 August to Beacon Woods, a new country park near Bean at least two miles from the tideway, where they saw round-leaved wintergreen *Pyrola rotundifolia* (previously found by the warden Mr Bullen), plentiful service tree *Sorbus torminalis* and maritime species *Juncus maritimus* and *Bolboschoenus maritimus*. Leafy-fruited nightshade *Solanum sarrachoides* seen by them on that day could not be correctly identified until a later visit when the accrescence of its calyx was more evident. At Hextable he found subsp. *bonannii* of strawberry clover *Trifolium fragiferum* in artificial grassland, together with the alien var. *sativus* of *Lotus corniculatus*. As well as the calyx character given by Stace (1991), which from now on will be the standard for identification and nomenclature in these papers, Mr Palmer comments that the plants of the subspecies grow more or less upright, to about 35 cm from the ground. Around planted trees at Stone Mr Palmer found plants of annual mercury which match the description in *Flora europaea* (Tutin 1968) of *Mercurialis huetii* Hanry, having long spreading branches and small fruits without stiff hairs on the surfaces though ciliate along the margins; this variant of *M. annua* has a distinctive natural range in France and must have been introduced independently of and much more recently than the common weed.

Most of my own more interesting discoveries in 1993 relate to a strip of land alongside the River Darent above Lullingstone Castle, which during the preceding winter was banked up into a series of bunds to contain dredgings from the bed of the adjacent lake, as part of a series of improvements to the angling. All the records relate to the period between 3 July, when I went over part of the ground with a London Natural History Society party, and about two months later when the last part of the bank was levelled. The flora of this temporary site consisted mainly of large numbers of plants which must be presumed to have arisen from seeds in the dredgings: *Rorippa palustris*, *Ranunculus sceleratus*, *Persicaria maculata*, *Bidens cenea*, *B. tripartita*, etc., many of which are seldom seen in the Darent Valley. Young plants of crack willow *Salix fragilis* and lesser reedmace *Typha angustifolia* could conceivably have been brought as seed by the wind. Mr Kitchener added to my list from here marsh dock *Rumex palustris* and a dock hybrid *R. × pratensis*. Nearby he found about 80 plants of night-flowering catchfly *Silene noctiflora* in stubble where he had previously seen this rare weed in 1989; I have yet to see it there, but I did see it at the edge of the new golf course in the Austin Lodge Valley. Other records by Mr Kitchener include three unusual alien shrubs, *Berberis gagnepainii* in oak woodland at Farley Common near Westerham, *B. thunbergii* in a cement waste area at Northfleet, and a patch of about a square metre of *Pachysandra terminalis* in Watercroft Wood, Halstead. Remarkably, our meeting of 3 July already referred to, which also walked the length of the best area of chalk grassland in Lullingstone Park, failed to see any of the three flowering spikes of lizard orchid *Himantoglossum hircinum* seen earlier by Beryl and John Hodge. This record is one of several for which I am indebted to the botany section of the annual report of the Orpington Field Club, compiled by Joyce Pitt. Mrs Pitt's own best record from our area in 1993 was of yellow bird's-nest *Monotropa hypopitys* in a beech plantation in the same part; she found 40 fruiting spikes late in the year when searching for fungi.

Finally from Kent, I have a few details of the plants found in the course of a survey by Cobham Resource Consultants of the proposed course of the Union Railways link to the Channel Tunnel in the London Area. On the Kent side of the river they have supplied details of the precise locations in the Ebbsfleet valley of yellow vetchling *Lathyrus aphaca*, narrow-leaved everlasting-pea *L. sylvestris* and catmint *Nepeta cataria*, all of which are commoner hereabouts than anywhere else in the London Area.

Surrey

With the exception of Ron Parker's *Chionodoxa forbesii* on Wrythe Green, and Peggy Dawes' Japanese wineberry *Rubus phoenicolasius* in Oaks Park, both localities

in the London Borough of Sutton, all the London records to be mentioned in this section are from the Borough of Richmond-upon-Thames. Mr Parker found *Smyrniium perfoliatum*, an exotic relative of alexanders, which seems to be turning up more commonly than it used to, by a path near Barnes Station, and on waste ground nearby, on the site of the former coal-yard, was where Mary Clare Sheahan gathered the hawkweed *Hieracium diaphanum* which I matched at the Natural History Museum. She also found the alien *Gnaphalium purpureum* growing out of a wall in Kew Road; this species is in Stace (1991) on the strength of its earlier presence on the wrong side of the wall of the Royal Botanic Gardens, but it had been thought lost. We had two 1993 field meetings in Richmond Park; the earlier one, on 25 April, confirmed the presence of ivy-leaved crowfoot *Ranunculus hederaceus* in its only surviving Surrey locality, and the leader on that occasion, Bill Cathcart, the deputy superintendent of the Park, later found a plant of the broad-leaved helleborine *Epipactis helleborine* in a plantation in the Park. The depressing pollution of ponds by invasive plant species continues; Elizabeth Norman visited the pond in the Park where our meeting in July 1984 found *Myriophyllum alterniflorum* and of course it now sports *Crassula helmsii* and water-soldier *Stratiotes aloides*, and also Ham Pond which used to be ringed by round-fruited rush *Juncus compressus* now has very little of the latter, still some buttonweed as reported last year, and parrot's-feather *Myriophyllum aquaticum*.

Just outside the Sutton boundary is Howell Hill, Ewell, where chalky ground originally intended as the site of a school which was never built is now a designated nature reserve. Mr Parker listed nine *Cotoneaster* species and *Lavatera olbia* from here, Mrs Norman collected two different hawkweeds, and John Montgomery counted 53 plants of garden speedwell *Veronica longifolia*, so it has evidently received a lot of attention in 1993. The last record was extracted from the Surrey Flora Committee's annual newsletter, which is also my source for 18 flower-heads of hairy garlic *Allium subhirsutum* found at Caterham by Gwyneth Fookes, several plants of scurvy-grass *Cochlearia officinalis* found on waste ground at Chertsey by Barry Phillips, two small colonies of greater yellow-rattle *Rhinanthus angustifolius* observed on Ashted Common in the first instance by J. Coombs, a 'spectacular quantity' of almond willow *Salix triandra* at West Molesey seen by Ken Page, Julia Leslie and the newsletter compiler Joyce Smith, and the yellow-flowered strawberry *Duchesnea indica* seen in Ewell village by the same trio.

Essex

The 1993 records from London boroughs in this part of our area which I wish to repeat here are all the result of field work by John Archer of the London Ecology Unit. On the top of the Northern Outfall sewer bank just west of the railway line into Stratford, Mr Archer found a few patches of the rare casual annual woundwort *Stachys annua* which I confirmed for him. I do not know of an earlier Essex record, nor can I suggest how it could have been introduced. A single plant of gromwell *Lithospermum officinale* on waste ground near the Essex end of the Thames Barrier was the best plant offered from that site, and others were fern-grass *Catapodium rigidum*, golden melilot *Melilotus altissima* and twiggy spurge *Euphorbia* × *pseudovirgata*.

East of the London boundary, the survey by Cobham Resource Consultants referred to above found a large clump of wood small-reed *Calamagrostis epigejos* and several outliers on Beacon Hill near Purfleet. Ken Adams mentioned to me that bell-heather *Erica cinerea*, believed extinct in Essex for over twenty years, had reappeared in Long Running, Epping Forest, after management work to be referred to again later in this paper.

Herts.

None of our 1993 records from this county refers to sites in a London borough. George Hounsome's records included a single plant of crown vetch *Securigera varia* near a gravel-pit at Amwell. Ian Johnson found few-flowered garlic *Allium paradoxum*

as a garden weed escaping by the canal at West Hyde. Further north by the same canal Peter Ellison found a very few plants of marsh valerian *Valeriana dioica* below the West Herts Golf Club, corn chamomile *Anthemis arvensis*, a rare plant nowadays, in a recently disturbed cutting by the A41 and a very few plants of pale sedge *Carex pallescens* in Bishops Wood. By far his best discovery to be reported here, however, provided it can be adequately confirmed, is of a large patch of the hybrid between the field and great horsetails, *Equisetum arvense* \times *telmateia*, on a roadside the exact locality of which would be better left undisclosed, as the hybrid is new to science and awaits a formal description.

All other Herts. records worth mentioning here were contributed by Ann Boucher. At this point I should state that the *Spergularia marina* given here a year ago (Burton 1993: 118) as being by the M1 was in fact by the A1(M) and could not be found in 1993. Of the usual large quantity of her records, perhaps the most interesting are the scarce plants whorled water-milfoil *Myriophyllum verticillatum* abundant in a pond at the Sir Frederick Osborne School, near Welwyn Garden City, where its status is called into question by the accompanying alien *Lagarosiphon major*, orange foxtail *Alopecurus aequalis* as a weed among bog plants in a nursery at Cole Green, and floating spike-rush *Eleogiton fluitans* in a similar situation near Blackfan Wood, where it was abundant and certainly not planted by the present owners who have been there a number of years. She found a large patch of plants of broad-leaved spurge *Euphorbia platyphyllos* in a cornfield at Thundridge, and at the edge of a field on the Theobald's Estate at Cheshunt she collected a specimen from among thousands of plants of a grass which I identified as rye brome *Bromus secalinus*. A very large bank of gravelly soil at the edge of a substantial building site on King's Meads between Hertford and Ware was home not only to a lot of *Trifolium striatum* and small numbers of round-leaved cranesbill *Geranium rotundifolium*, small melilot *Melilotus indica* and hoary mustard *Hirschfeldia incana*, which are not totally unexpected on such sites, but also to four plants of a rock-garden plant from the western Alps which I have yet to see under its correct name *Erysimum jugicola* Jordan in the gardening literature; even the generally accurate new Alpine Garden Society *Encyclopaedia of alpines* (Beckett 1993) calls it '*E. helveticum* (Jacq.) DC. (syn. *E. pumilum*)', running together wrong names for two species.

Middlesex

I claim as the most centrally located record of interest from 1993 the plant of polypody I found on an old wall in Wild Court off Kingsway, perhaps quite ancient but still too stunted to be clearly referable to any of our *Polypodium* species. It is run close by Elinor Wiltshire's crop of finds in Hyde Park and Kensington Gardens, reported on in a separate paper also in this issue of *The London Naturalist* (Wiltshire 1994), by the large population of grey sedge *Carex divulsa* in the Moravian Burial Ground, Chelsea, mentioned as a feature of this cemetery in the London Ecology Unit's schedule of sites of nature conservation interest in the Borough of Kensington and Chelsea, by the plant of vervain *Verbena officinalis* found by the LEU's Meg Game in the Jewish Cemetery, Bethnal Green, and by the discovery at our meeting of 18 September of the large-flowered waterweed *Egeria densa* in the Hertford Union Canal; this alien relative of the more familiar *Elodea* was represented by three or four large rooted plants and numerous detached fragments, and was previously known in Britain only from a canal near Manchester. I had many more records of Sumatran fleabane *Conyza sumatrensis* from Inner (and Outer) London, of which it is hoped to publish a map in these pages next year, but our members have not yet mentioned to me the similar species *C. bonariensis* reported as naturalized in streets north of Euston by Wurzell (1994).

Mention has already been made of potentially devastating alien plants appearing mysteriously in ponds. Leslie Williams sent me material for identification he had collected from the pond in the field called Gotfords in Fryent Country Park listed in his

recent paper (Williams and Green 1993) which turned out to be *Myriophyllum aquaticum*. It occurs to me that this species may somehow be accidentally introduced in the process of pond creation or restoration, activities which are being increasingly carried out by enthusiastic local nature conservation groups. The same applies to *Cotula coronopifolia*, of which an earlier recent London record has come to light, by Mr Archer in 1991 in the pond in the Oak Avenue Nature Reserve, which is near Hanworth though just in the Richmond-upon-Thames boundary; I believe all the ponds where it has suddenly appeared recently have been worked on. In the same spirit, heather *Calluna vulgaris* which had been thought extinct on Hampstead Heath has been re-introduced there, though this activity is unconnected with the four small groups of it found on the Heath near some old gorse by Edward Milner.

A number of recorders already mentioned have also made contributions from London boroughs in Middlesex. Mr Hounscome's include *Allium subhirsutum* thoroughly naturalized on a pavement in Palmers Green and an individual of the rare bird-seed alien *Fagopyrum tataricum*, the identity of which has been confirmed by Dr J. R. Akeroyd, in Waterlow Park. Dr T. A. Cope was the expert who confirmed Mrs Norman's material of water bent *Polypogon viridis* in Warwick Road. Mrs Wiltshire found a small patch of lesser sea-spurrey *Spergularia marina* on Haste Hill Golf Course, Ruislip. People to be named for the first time here are Pippa Hyde who found purple toothwort *Lathraea clandestina* in an untended flower-bed in Bushy Park where it was assuredly not planted. Mr D. H. Kent communicated to me Michael Mullin's discovery of trailing snapdragon *Asarina procumbens* on an old wall at Gunnersbury Park. Mavis Pilbeam showed me a piece of *Smyrniium perfoliatum* she had found on Hampstead Heath. I do not know the name of the member of the Harrow Natural History Society who found cowslips *Primula veris*, now a rare plant in Middlesex, on Pinner Golf Course; this record came to me from the Society's recorder Eileen Dowley.

I have left until last the records sent me by Anthony Vaughan. One large plant of deadly nightshade *Atropa belladonna* and several robust plants of henbane *Hyoscyamus niger* were growing by a long-closed rubbish tip near Scratch Wood, where ground had recently been disturbed, which is perhaps the same as the 1946 locality near Scratch Wood mentioned as a henbane site by Kent (1975: 398) and is certainly near to the 1965–6 locality where it was frequent on ground disturbed in connection with the extension of the M1 Motorway in the same reference. On consolidated stony ground nearby there was one plant of the greater musk-mallow *Malva alcea*. However most of Mr Vaughan's records come from Mill Hill Golf Course in the same area, which he was able to explore thoroughly. They include one small service tree, cowslips in three places, two large patches of red-osier dogwood *Cornus sericea* created by suckering where originally it had been planted, pepper-saxifrage *Silaum silaus* in three places, betony *Stachys officinalis* in two, frequent bifid hemp-nettle *Galeopsis bifida* and hybrid sweet-grass *Glyceria* × *pedicillata* determined by Dr Cope. Best of all, however was the group of a couple of dozen plants of corky-fruited water-dropwort *Oenanthe pimpinelloides*. This is only the second record for Middlesex, the other, dating from 1915, being from 'a field near Hendon', which though very vaguely expressed can hardly have been the same place.

Oenanthe pimpinelloides in the London Area

There are no records to report this year from the non-London part of Middlesex or from Bucks., and I think it appropriate at this time to describe the present known distribution of this species in the London Area, which is very different from what was known at the time of preparation of our current flora (Burton 1983), according to which it 'is known only from a few grassy places, often with bushes as wind-breaks, on clay soils in Kent and Surrey. There are several plants on Epsom Common and a few, in some years none, at Crofton Heath. Its occurrence on Southborough recreation ground in 1970 fits into a pattern which defies explanation: single plants appear in new places, last a few years, then vanish. So it was south of Chessington church in 1959, at Warlingham in 1951–54, between Bickley and Petts Wood on a golf course (there is no

golf course there now) in 1943–48, on Darenth Meads in 1946, on Putney Heath in 1936 and about the beginning of the century near Weybridge and on Epsom Downs.' That is to say, there was one site with several plants where it could reliably be found, and one more which was less secure.

Now there are about six well-established populations known, some of them with very large numbers of plants. In Kent the best colony is that in Jubilee Park with many thousands of plants scattered across a wide area. This is the same as the golf course mentioned, which was let for grazing when the West Kent Golf Club moved to its present site at Downe, until purchased by Bromley Council in 1979. An excellent account of the natural history of this park has recently been published for the Orpington Field Club (Corbet 1993). In the same borough, the Crofton Heath site, which was well known, is reduced to one plant, but there is a colony in a cemetery near the recreation ground mentioned, first found by Geoffrey Bird in 1988. Nearer London there is a well-documented colony on Pippenhall Farm near Eltham, though I must admit to having been unable to find for myself either this colony or the single plant on top of the hill between the A2 and the railway west of Mottingham which was also discovered by Barry Nicholson in 1983. In Surrey, Epsom Common continues to boast the only substantial population in our area (Figure 1), but the number of plants runs into hundreds. There were plants on similar ground on Ashted Common, but they have not been seen recently (K. Page pers. comm. 1988). A further small colony on the edge of our area near Hurst Green Station, which in 1992 numbered five plants, was first found in 1981 by J. C. Williams.

Mr Vaughan's discovery near Mill Hill is not the only colony of this species in our area north of the Thames. In 1983, in the course of a survey of meadows for the Essex Naturalists' Trust, Marcus Grace found it quite plentiful in one pasture of 1.5 hectares near Bell Common, Epping, and subsequent investigation discovered outliers of this population in two adjacent pastures. (There are also three Essex sites outside our area discovered shortly after). The Corporation of the City of London, which has the freehold of Epping Forest, including Bell Common, was able to acquire these meadows as an extension of the forest, but 'Between agreeing acquisition and obtaining possession ... several years elapsed, during which considerable scrub invasion took place. Some scrub clearance has been done but it needs more.' The text is taken from a report on the management of Forest grasslands and heathlands prepared in 1993 by Dr Amanda Samuels, ecological surveyor for the Corporation's conservators of Epping Forest, which gives as additional elements of the flora of the meadows petter saxifrage *Silaum silaus*, devil's-bit scabious *Succisa pratensis*, betony *Stachys officinalis*, creeping jenny *Lysimachia nummularia* and other species typical of old meadows on water-retentive clay soils.

This is clearly the characteristic habitat of *Oenanthe pimpinelloides*, which may explain why it is more abundant in an area ranging from east Devon through Dorset into south Somerset and the fringes of the New Forest than it is in the London Area, where populations must presumably all be regarded as relict. Some years ago Brian Wurzell supplied me with evidence of the ready ability of this plant to increase by seed in cultivation, and in the absence of any indication of longevity of its seed, I now believe that the peculiar reappearances and disappearances of the plant mentioned earlier are the result of its ability to persist unnoticed in a vegetative state. The basal leaves (the resemblance of which to those of some species of *Pimpinella* account for the specific name) are produced in winter and certainly suffice to nourish the tubers by which the plant perennates, even if flowering is repeatedly prevented by cutting or grazing.

Acknowledgement

As well as those people who are named in the text, Dr K. J. Adams needs a mention for his help with the Essex records of *Oenanthe pimpinelloides*.



FIG. 1. *Oenanthemum pimpinelloides*. Epsom Common, Surrey, 28 June 1987. Photo: R. M. Burton

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Book review

Insects. Text Jeanne Griffiths, illustrations Richard Lewington. Dragon's World, Limpsfield, Surrey. 1994. 45 pp. £3.99. ISBN 1 85028 285 4.

As we go to press we have received *Insects*, one of a six-part miniature series of 'Natures Treasures', all due to be published on 20 October at £3.99 in hardback with a glossy dust-jacket replicating the cover, with twenty-four colour illustrations and with page size 100 × 75 mm. The delightful illustrations in *Insects* are taken from the same publisher's *Insects of the northern hemisphere*, by George McGavin and Richard Lewington, which we reviewed in last year's *London Naturalist*. The insects depicted range from a mayfly, damselfly, cicada, water-boatman, beetles, flies, moths, 'skipper' butterfly (bearing the Latin name of the Essex skipper), to a wasp and a bee. Each illustration is opposite a short descriptive text, below which is a quote from a range of noted writers.

The other titles in the series are *Butterflies*, *Ducks*, *Gems*, *Trees* and *Wild flowers*. The publisher's press release states that 'This attractive series will also make perfect gifts' — I couldn't agree more.

K. H. HYATT

Watsonian vice-county boundaries in the London Area

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Summary

This paper describes the boundaries of counties in the London Area as they were before the passing of the Local Government Act 1888, and explains their significance to modern biological recording.

Introduction

The recording activity of the London Natural History Society produces results which not only may have local significance, but also form part of a national network of amateur activity with a varying degree of formality in its organization. The LNHS has chosen to make its recording area a circle of radius 20 miles (almost exactly 32 km) centred on St Paul's Cathedral, but this boundary has no obvious significance to those who view it from the outside, and inevitably our efforts overlap those of other bodies. National recording schemes collecting data from local bodies should be able to expect them to be able to sort out their arrangements. The interchange of records is a difficult enough business as it is, but some complications can be avoided if boundaries are clear and constant.

London offers an excellent example of the inconstancy of current administrative boundaries. A completely new unit was set up by the London Government Act 1963, with boundaries which came into effect in 1965 and have already been changed a number of times since. Before that there had been a County of London, created by the Local Government Act of 1888, with only about half the 1965 area.

The county boundaries which are used as a basis for natural history recording in Great Britain derive from the works of H. C. Watson, principally his *Topographical botany* (1873), which listed all the counties for which each vascular plant species was known. The larger counties were divided up into smaller areas which he called vice-counties, in order that the geographical units should be less unequal in size. Altogether there were 112 numbered units, so that the distribution of *Pimpinella saxifraga*, for instance, is given as 'Counties all, except 42, 60, 71, 74, 97, 98, 99, 103 to 107, 109 to 112'. To determine the boundaries of these units, it is necessary therefore to trace the county boundaries as they were understood by Watson, which pre-date the formation of the first County of London. Fortunately this work has been done, by a committee of six set up by The Systematics Association in 1947 or 1948, which produced a set of one-inch maps with the boundaries marked by hand, which can be consulted in the Botany Department of the Natural History Museum, and two sheets of 1:625,000 maps issued by The Ray Society with an accompanying booklet (Dandy 1969).

The Society's recording area comprises the whole of Watson's Middlesex and parts of Bucks., Essex, Herts., Kent and Surrey (Bucks. and Herts. are abbreviations used in his works, and it would be pedantic not to continue to use them). He divided Kent into two vice-counties, of which only West Kent is represented in our area, and Essex into two, North Essex and South Essex. The boundary between these is 'the high road from Waltham and Epping to Chelmsford ...' (Watson 1859). Though the line passing through the town of Waltham Abbey no longer carries the main road, this can still be traced without difficulty from the Herts. boundary at grid reference 373004 eastwards to the Wake Arms, then on the old A11 through the middle of Epping and the A122 through North Weald Bassett and High Ongar. Unlocalized records from Epping Forest and records from 'Waltham Abbey' cannot be placed in the correct vice-county with certainty.

Jermyn (1974) did not use the division into two parts in his Essex flora, but kept scrupulously to the same county boundary as had been used by his predecessor (Gibson 1862). Other recent local county flora writers have taken different approaches to the problem of their boundaries. Dony (1967) most usefully mapped the Hertfordshire boundary in all its changes and collected records both from the Watsonian county and the current one of his day. Kent's (1975) work specifies in its subtitle that a Watsonian 'vice-county' is covered but notoriously contains no map to illustrate its boundaries. Philp (1982) used the modern boundary of Kent in his atlas, which has already changed in a number of places.

The marked one-inch maps which I have studied at the Natural History Museum for the preparation of this paper are numbers 239, 240, 255 to 257 and 269 to 271 of the 1893-4 revision, published by the Ordnance Survey Office, Southampton in 1893 (no. 255) or 1896. It is not clear why an edition so much later than any of Watson's time was used, but in parts of London where the present street plan was already laid down by 1893 the lateness of this edition is certainly useful.

The sequence in which the boundaries are described below begins with a circuit of Middlesex, taking its boundaries with Bucks., Herts., Essex, Kent and Surrey in turn. The boundaries between Surrey and Bucks., Bucks. and Herts., Herts. and Essex, Essex and Kent, and Kent and Surrey follow, each described in the outward direction. Figure 1 illustrates this sequence diagrammatically.

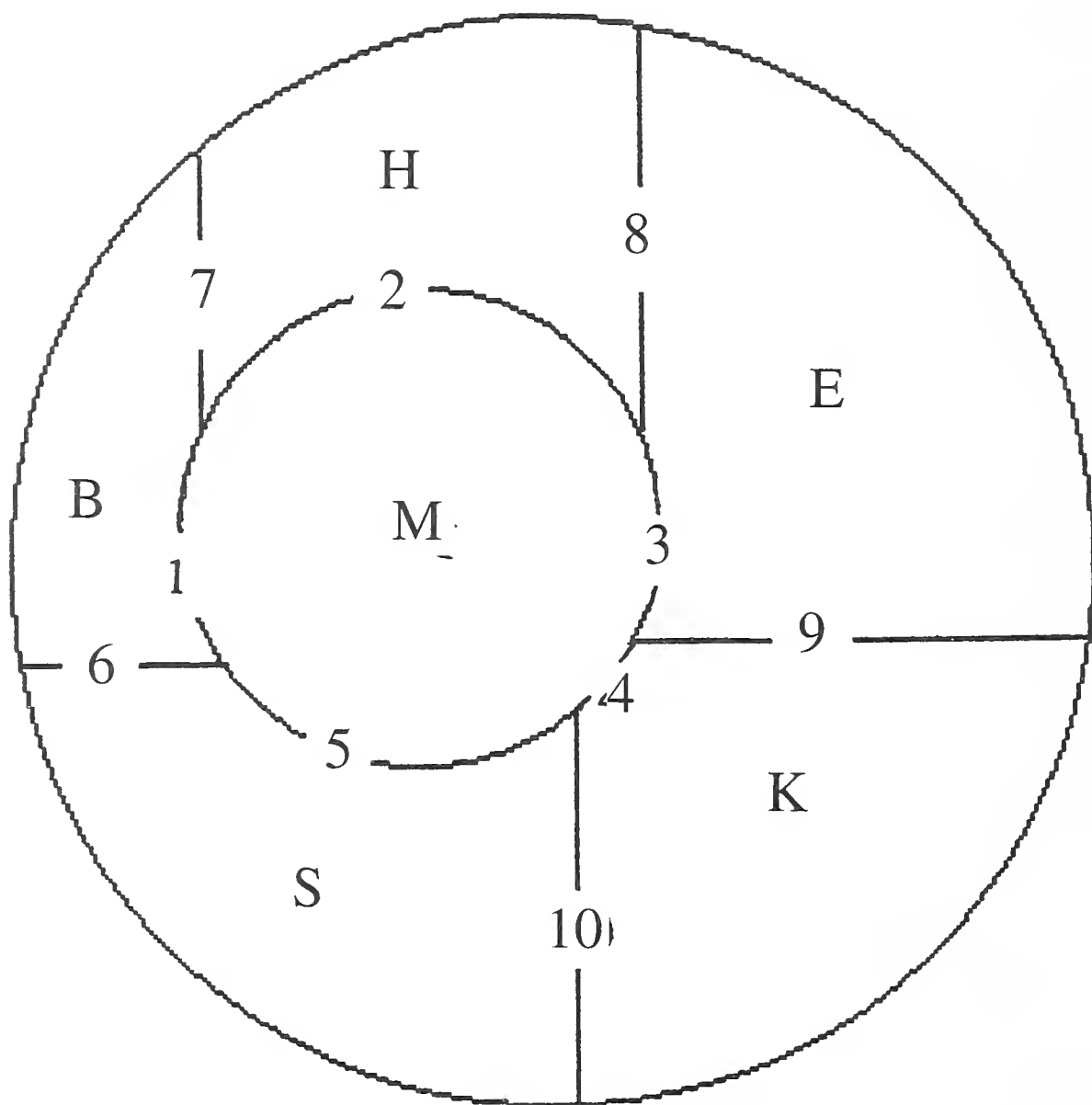


FIG. 1. Diagrammatic representation of the sequence of boundaries described. The outer circle represents the limit of the LNHS recording area, the London Area.
Legend for all figures: B Bucks., E Essex, H Herts., K Kent, M Middlesex, S Surrey.

1. Middlesex–Bucks.

This boundary needs to be considered in two parts. When the County of Greater London was created, the County of Middlesex was abolished and its south-west portion, including most of the ground since flooded to make Wraysbury Reservoir, became the Spelthorne District of the County of Surrey. The southern part of this boundary therefore now has Surrey on its eastern side. On its western side, the parishes of Wraysbury, Horton and Datchet in our area, including the access to the Reservoir, have been transferred from Bucks. to Berkshire, so that the modern south extremity of Bucks. is at Colnbrook. This part of the boundary can therefore be traced on modern maps as the boundary between Surrey and Berks. and not between Middlesex and Bucks.! It runs from the south bank of the Thames at Egham Hythe 027716, crosses the river and until it reaches Wraysbury Reservoir bank is shown on the Ordnance Survey 1:25,000 map with the name of County Ditch.

The northern part of this boundary runs from 040768 on the course of the Wraysbury River now under the M25 Motorway to the junction with Herts. near West Hyde at 039900. This is still the boundary between Bucks. and the London Borough of Hillingdon throughout its length, except that about 600 metres at its southern end have been realigned, with effect from 1 April 1994, to the western fence of the M25 north of Longfordmoor, by Report no. 665 of the Local Government Boundary Commission for England. A length of about 300 metres north of Uxbridge is a watercourse called Shire Ditch. From a point near Denham Lock northwards this boundary is the same as the course of the River Colne.

2. Middlesex–Herts.

This is the longest and most complicated county boundary in our area. From the corner of Bucks. at 039900 north to the bend between Springwell and Mill End and then east as far as 207950 near Stirling Corner it was until 1 April 1993 the same as the modern boundary between Herts. and the London Boroughs of Hillingdon, Harrow and part of Barnet, and members would be well advised to retain maps in their possession for the sake of the current boundary information, even if other information on them has been superseded in more recent editions. On the date mentioned, the stipulations of Report no. 610 of the Local Government Boundary Commission for England moved the Herts.–Harrow boundary at the north-east corner of Harrow Weald Common so that it runs along Hive Road past Kestrel Grove and then along about 500 m of the A409 road to rejoin the original boundary where it crosses Heathbourne Road. A more significant change introduced at the same time takes the Herts.–Harrow boundary south to the M1 Motorway as far as the west corner of Scratch Wood, so that for the first time Elstree Hill open space, Elstree open space and Deacons Hill open space are in Herts.

From the point at 207950 mentioned in the previous paragraph, there is a long stretch most of which coincides with no modern boundary. Figure 2 shows the line in the neighbourhood of Barnet Gate and Hendon Wood Lane to where it joins the Folly Brook near its source in Holecombe Dale. Boundary House is the last property on the Middlesex side of the line on Totteridge Common. Folly Brook is followed downstream through the middle of the artificial Darlands Lake, now the site of a nature reserve which is bisected, to the point where it meets Dollis Brook, which is followed upstream. The South Herts. Golf Course is all on the Herts. side of the Dollis Brook, as might be expected, whereas the adjacent Brook Farm open space is on both sides. Arkley, Totteridge village and Laurel farm are all in Herts. All this territory is now in the London Borough of Barnet.

Figure 3 shows the line of the boundary from the Dollis Brook south-east as far as Oakleigh Road South. The street called County Gate just north of the line presumably takes its name from a structure on the Great North Road at its east end. New Barnet, Oak Hill Park and Brunswick Park north of this line are all in Herts. At Betstyle Circus, the line turns at a right angle along Waterfall Road as far as Waterfall Close. Friern Barnet, where some interesting plants were found in 1991, is south of Betstyle Circus

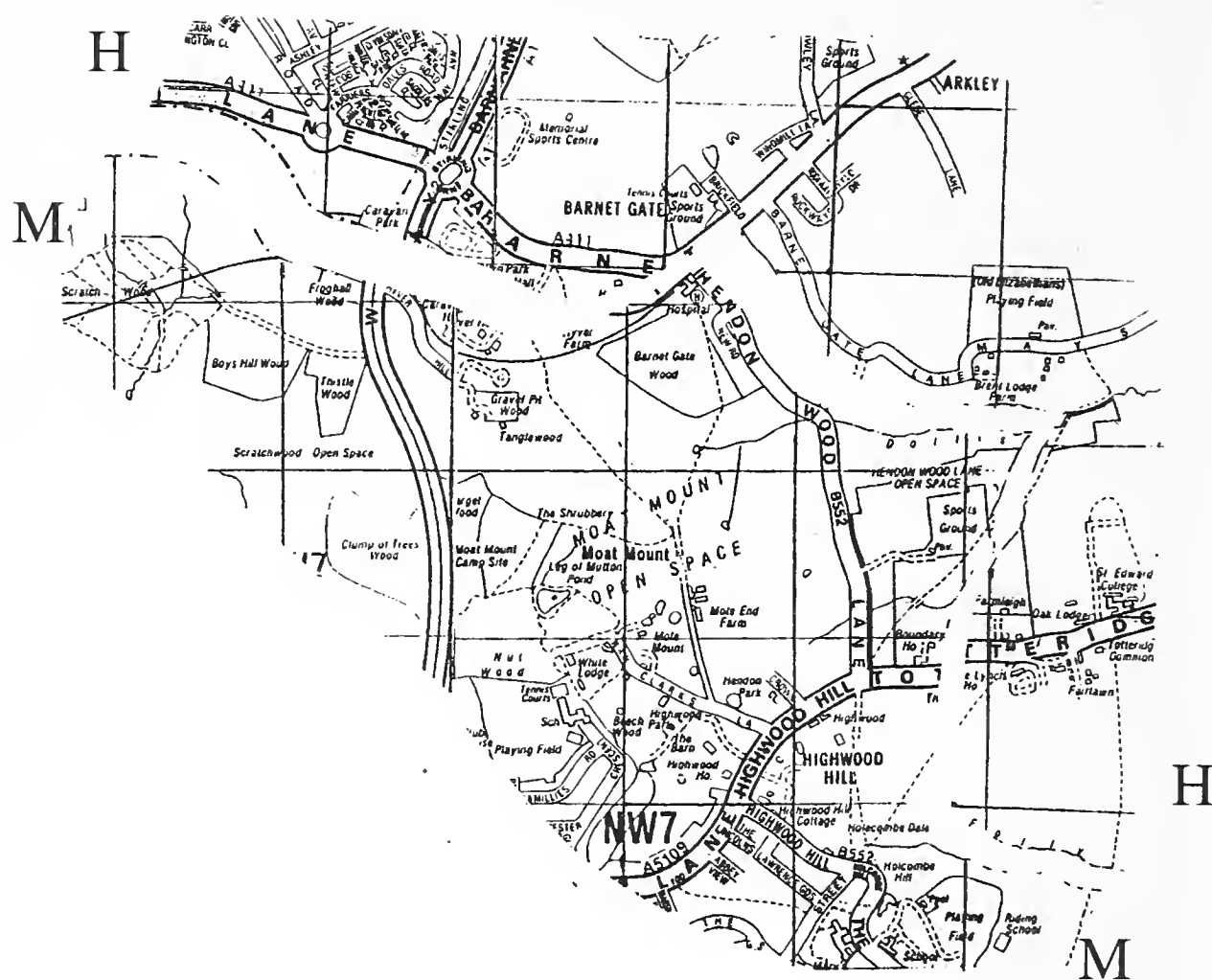


FIG. 2. Middlesex-Herts. boundary from near Scratch Wood to Folly Brook. In this and the following figures, the boundary is shown by cutting a section of map along it and separating the parts. The parts can be matched by means of the grid lines, which are at 500 m intervals. Reproduced by permission of Geographers' A-Z Map Co. Ltd, from maps based on © crown copyright Ordnance Survey material.

and therefore in Middlesex and not in Herts. as stated by me (Burton 1992:179). Figure 4 shows the boundary in the neighbourhood of Southgate, from Waterfall Close to a point on Chase Side. The east part of Figure 5 continues from farther up Chase Side to near West Farm Place in the neighbourhood of Cockfosters. With minor modifications introduced by Report no. 672 of the Commission, the boundary between Herts. and Middlesex from Betstyle Circus to Cockfosters is the same as that between the London Boroughs of Barnet and Enfield.

From the point near West Farm Place mentioned the boundary continues *westwards* through the middle of Barnet to the bend a little way along Galley Lane between Barnet and Arkley, as shown in the rest of Figure 5 and in Figure 6. This remarkable reversal of direction leaves a tongue of Herts. running from Arkley to Brunswick Park with Middlesex both to north and south. A cartographical colleague has suggested to me that this indicates the extent of lands belonging to St Alban's Abbey before the dissolution of the monasteries in the reign of Henry VIII. It also needs to be explained why the town of Barnet, like Royston on the other side of Herts., should have sat exactly on the boundary. The explanation that has been offered is that it was advantageous to the townspeople to be able to have fairs licensed by two sets of magistrates. When Barnet was made the northern limit of the 1888 County of London, a new county boundary was created slightly further north, dividing Beech Hill Lake and separating Monken Hadley Common from Hadley Wood in the remnant County of Middlesex; this continues to be the boundary between the London Boroughs of Barnet and Enfield.

From Monken Hadley to Galley Lane, the 1888 county boundary separates Barnet from the modern County of Herts.

From the bend in Galley Lane for about 3,000 m in an almost straight line north-north-westwards, the original Middlesex–Herts. boundary was from 1965 the boundary between Herts. and the London Borough of Barnet, the Herts. portion being on the east side in original Middlesex and the Barnet portion on the west including Rowley Green and Saffron Green being in original Herts. This line continues along Galley Lane to the corner of Dyrham Park and then runs through the park and across the modern A1 trunk road. However since 1 April 1993, in accordance with Report no. 665 of the Local Government Boundary Commission for England, Saffron Green and the western part of Dyrham Park have been restored to Herts. The same more northerly direction is maintained along the parish boundary between Ridge (in Herts.) and South Mimms (in Middlesex) as far as the present A6/A111 junction north-west of South Mimms, at which point it curves round, still following the boundary of South Mimms, between Hawkshead Wood (Herts.) and Mimmshall Wood (Middlesex, largely felled) before crossing the modern A1 for the last time near Warrengate south of Water End.

The last stretch of this long boundary runs from here approximately eastwards towards Essex, starting on old field borders, including the northern sides of Pilvage Wood and Potters Bar Golf Course west and east of the main railway line, until it gets to the angle of Heath Road, Potters Bar, where it gets lost in modern streets which

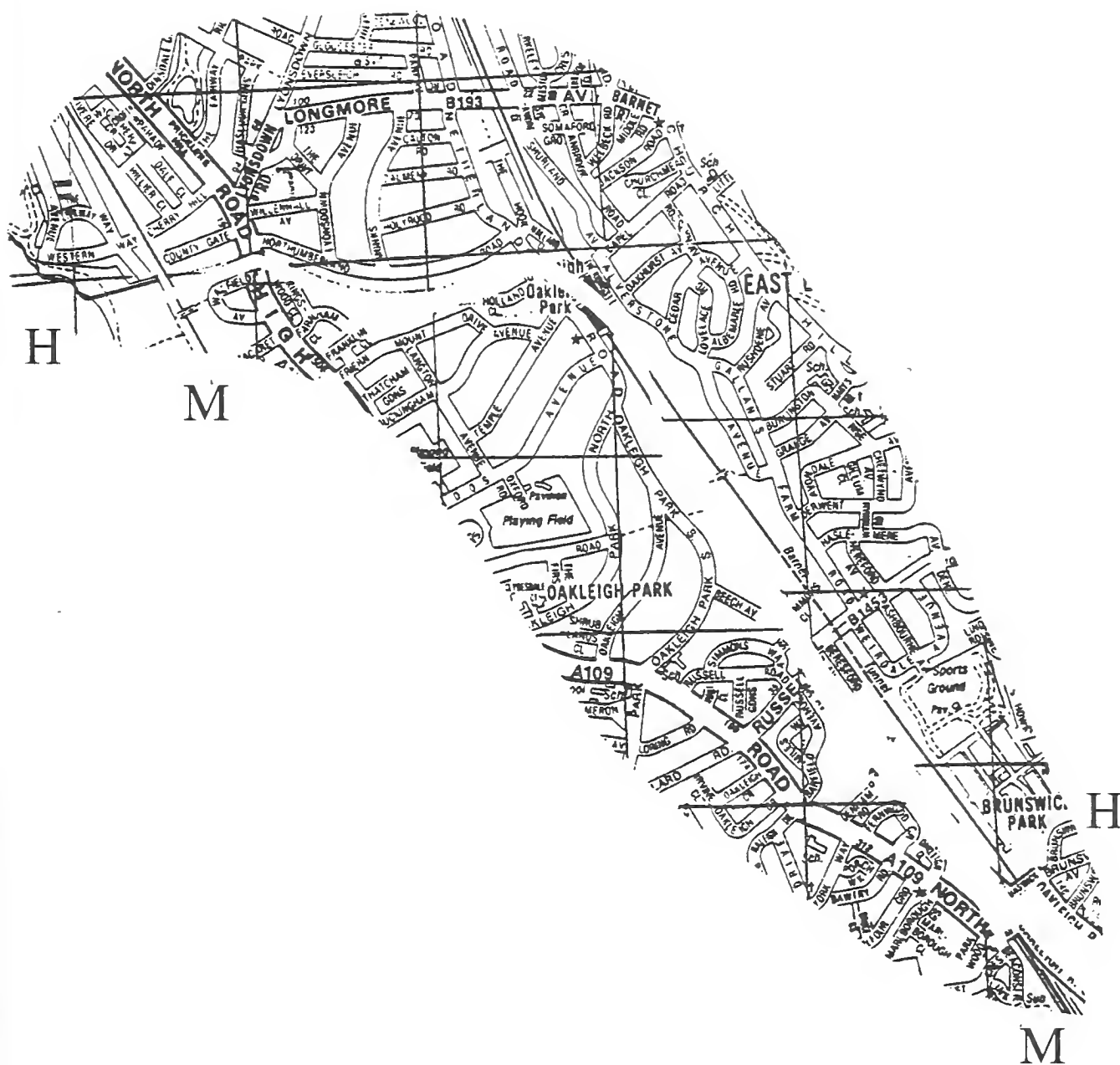


FIG. 3. Middlesex–Herts. boundary from Dollis Brook to New Southgate. Reproduced by permission of Geographers' A-Z Map Co. Ltd, from maps based on © crown copyright Ordnance Survey material

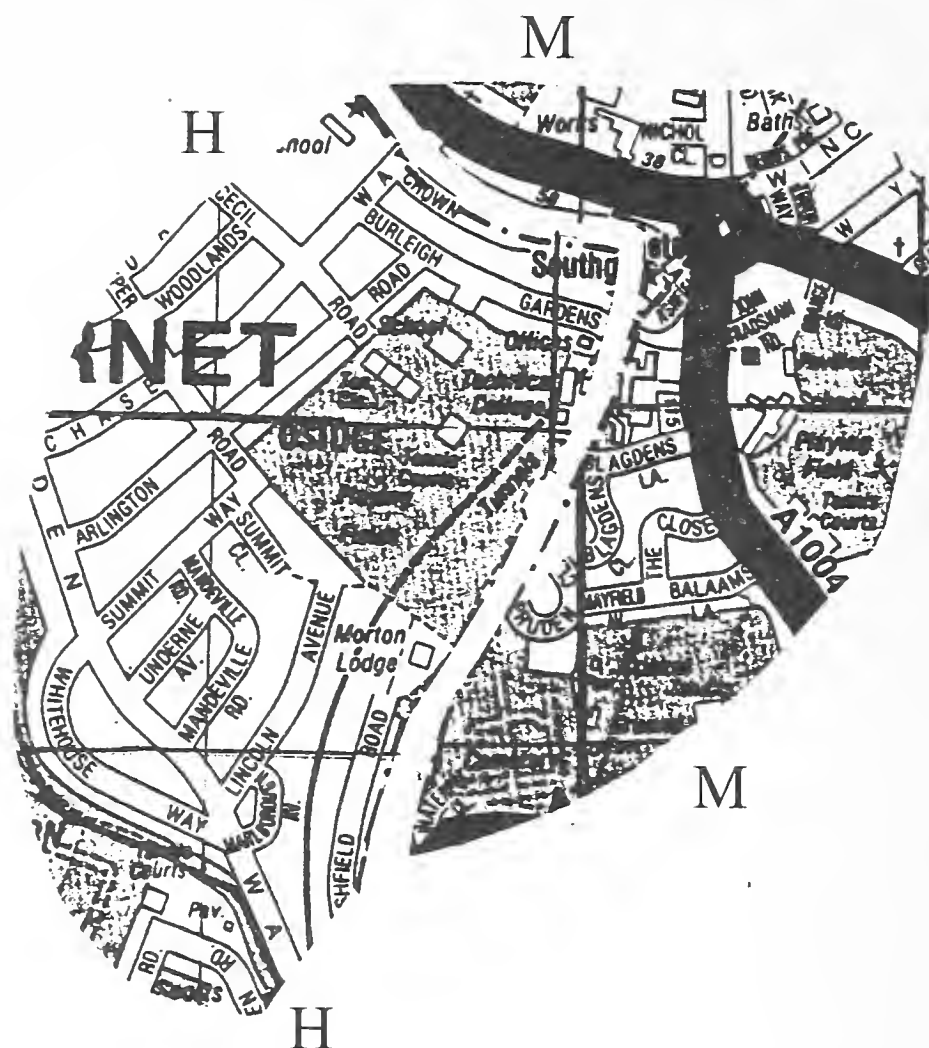


FIG. 4. Middlesex-Herts. boundary near Southgate. Reproduced by permission of Geographers' A-Z Map Co. Ltd, from maps based on © crown copyright Ordnance Survey material

ignore it. Though Potters Bar is now in Herts., this is still the boundary between the Hertsmere and Welwyn Hatfield Districts of the modern county. Figure 7 shows part of its course. North Mymms and Northaw and Cuffley to the north have always been in Herts. The rest of the line, along almost the whole length of Coopers Lane Road, then past Cattlegate Farm and Crews Hill Paddocks, between Bulls Cross and Theobalds Park and then just south of Waltham Cross continued to be the northern boundary of the London Borough of Enfield until 1 April 1994, when it was moved by the Commission's Report no. 672 to the northern fence of the M25 Motorway. This move has transferred Five Acre Wood, Fir Wood and Pond Wood to Herts.

3. Middlesex-Essex

This boundary runs southwards from the west bank of the River Lea Diversionary Channel by Waltham Abbey Town Mead at 375999 down the Lea Valley to the Thames at 394804. Its winding detail strongly suggests that it follows a course of the River Lea all the way, though it matches the present course of the river only in places, notably between the Middlesex and Essex Filter Beds near Lea Bridge and for much of the tidal stretch. The line is shown as a boundary on current maps, with Essex and the London Boroughs of Waltham Forest and Newham to the east and the London Boroughs of Enfield, Haringey, Hackney and Tower Hamlets to the west. However, between High Bridge and Horseshoe Bridge below Springfield Park current maps show the line following a small loop of river where the detail drawn by Dandy follows a straight cut, as shown in Figure 8. Current maps have been made out of date by the reports of the Local Government Boundary Commission for England nos. 618, 661 and 672, which

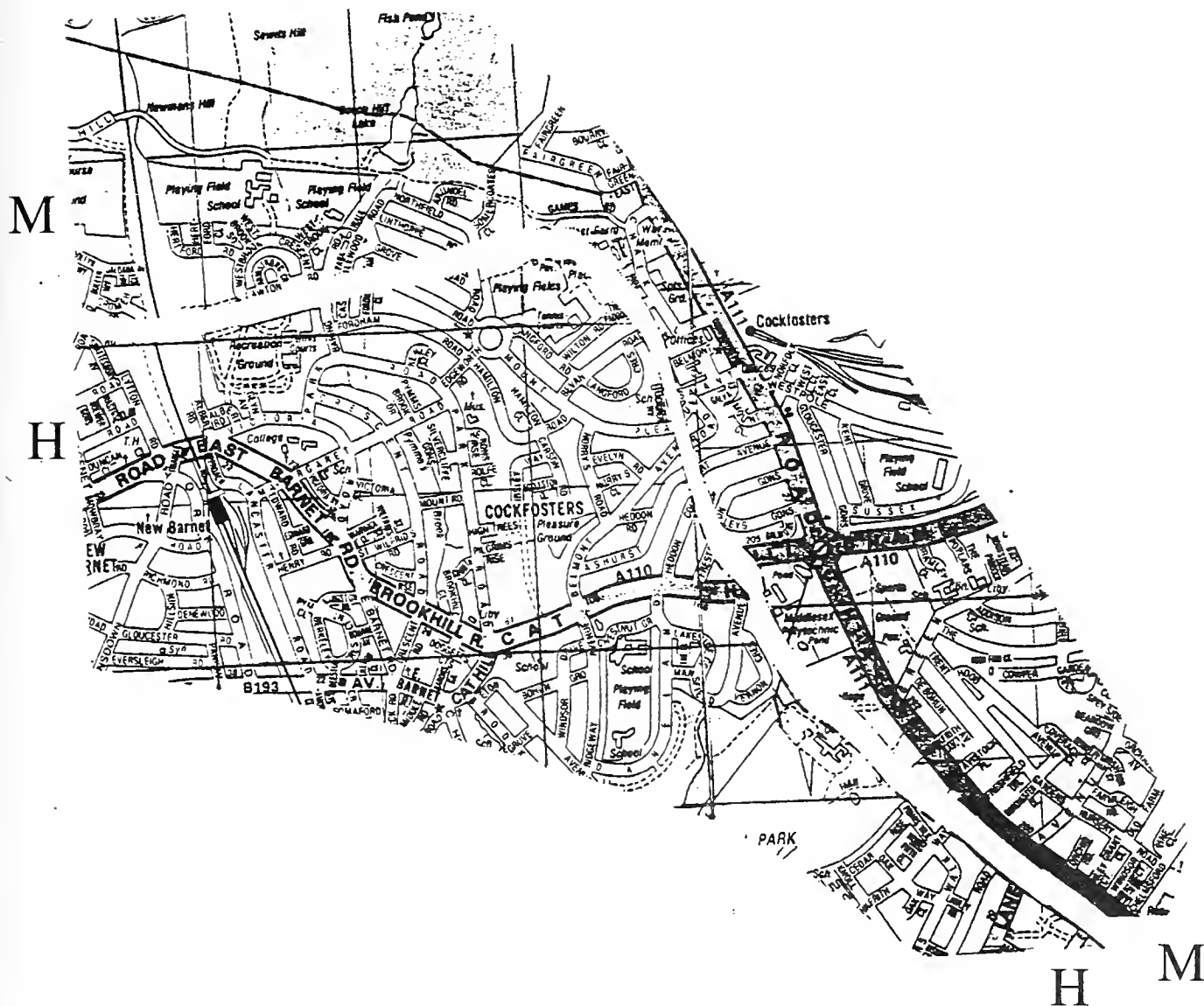


FIG. 5. Middlesex-Herts. boundary near Cockfosters. Reproduced by permission of Geographers' A-Z Map Co. Ltd, from maps based on © crown copyright Ordnance Survey material.

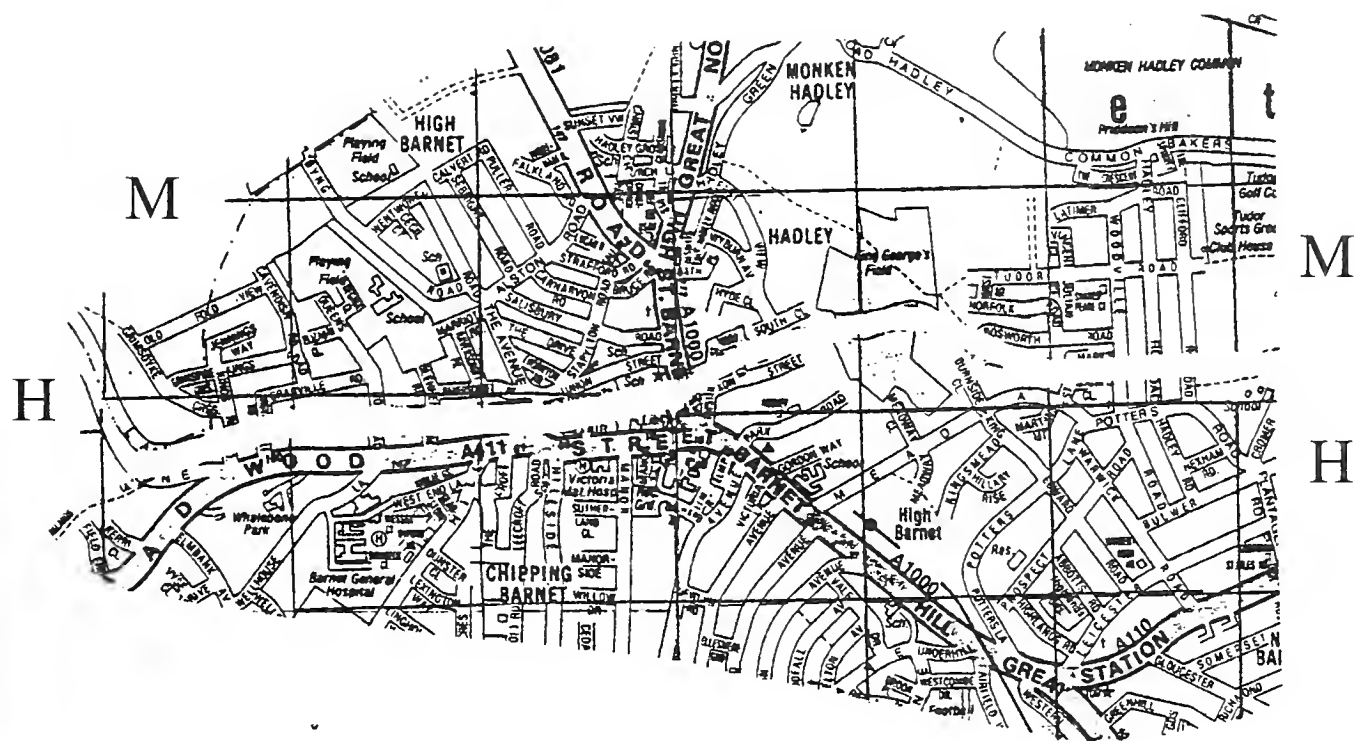


FIG. 6. Middlesex-Herts. boundary through Barnet. Reproduced by permission of Geographers' A-Z Map Co. Ltd, from maps based on © crown copyright Ordnance Survey material.

5. Middlesex–Surrey

This continues up the Thames to the beginning of sect. 1, but is a much longer stretch with several complications on the way. As far as Twickenham Bridge carrying the A316 across the river, it is a modern boundary, so that all of the London Borough of Tower Hamlets, the Cities of London and Westminster and the London Boroughs of Kensington & Chelsea, Hammersmith & Fulham and Hounslow are in Middlesex and all of the London Boroughs of Southwark, Lambeth and Wandsworth are in Surrey. Brentford Aits, though separated from Kew by the main course of the Thames, are in Surrey. Isleworth Ait is divided, part of the south end being in Surrey, though since 1 April 1994 it has ceased to be divided and the whole island is in the London Borough of Hounslow, in accordance with Report no. 652 of the Local Government Boundary Commission for England.

The Surrey side of the Thames here is occupied by the London Borough of Richmond-upon-Thames, which is on both sides of the river from Twickenham Bridge upstream until succeeded on the Surrey side by the London Borough of Kingston-upon-Thames. Within Richmond, Corporation Island and other small islands just below it are in Surrey, Glover's Island opposite Petersham Meadows is in Middlesex, Eel Pie Island is in Middlesex, and the islands at Teddington Lock are in Surrey. Between Richmond on the Middlesex side and Kingston on the Surrey side, Steven's Eyot and

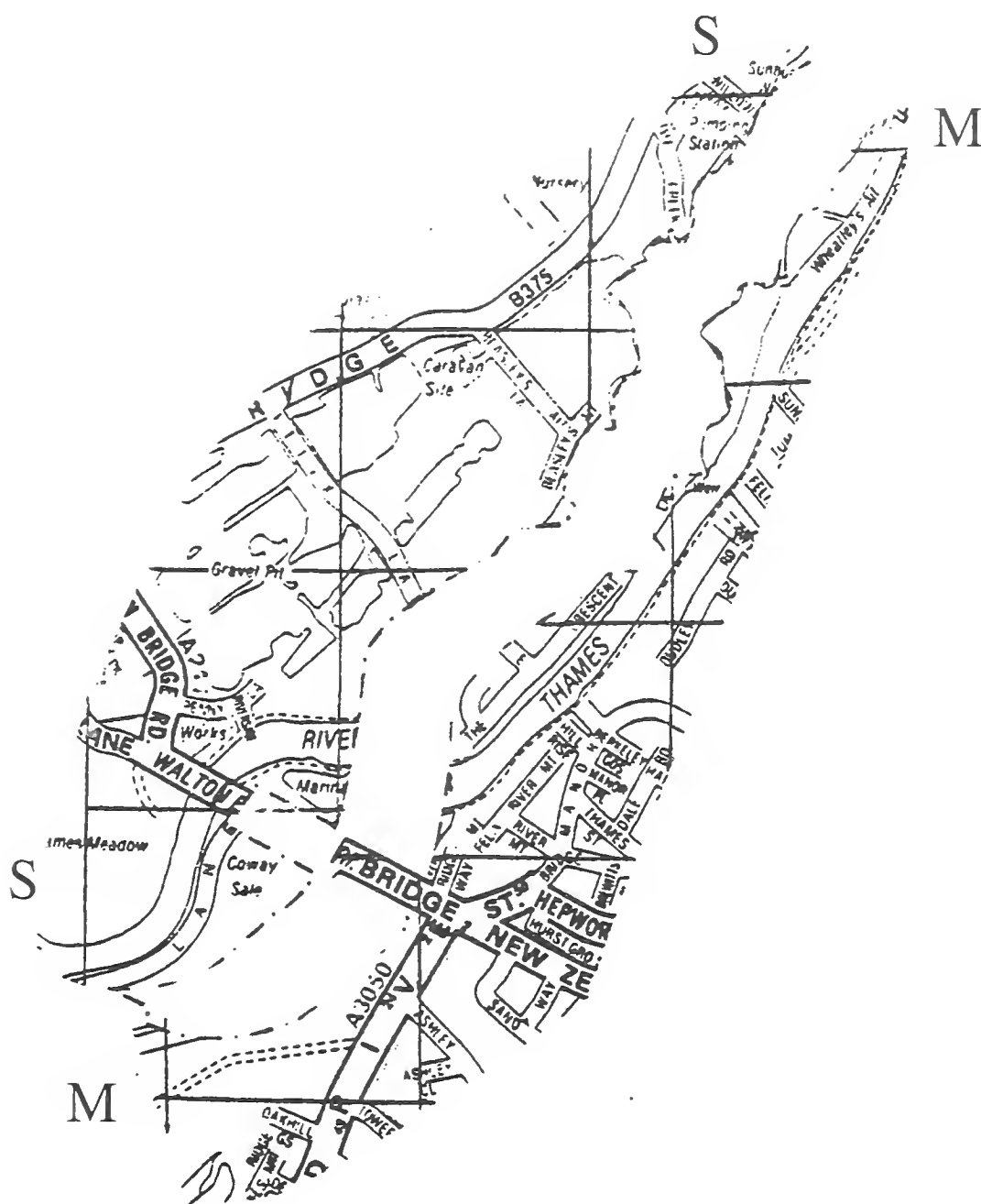


FIG. 9. Middlesex–Surrey boundary near Walton-on-Thames. Reproduced by permission of Geographers' A–Z Map Co. Ltd, from maps based on © crown copyright Ordnance Survey material.

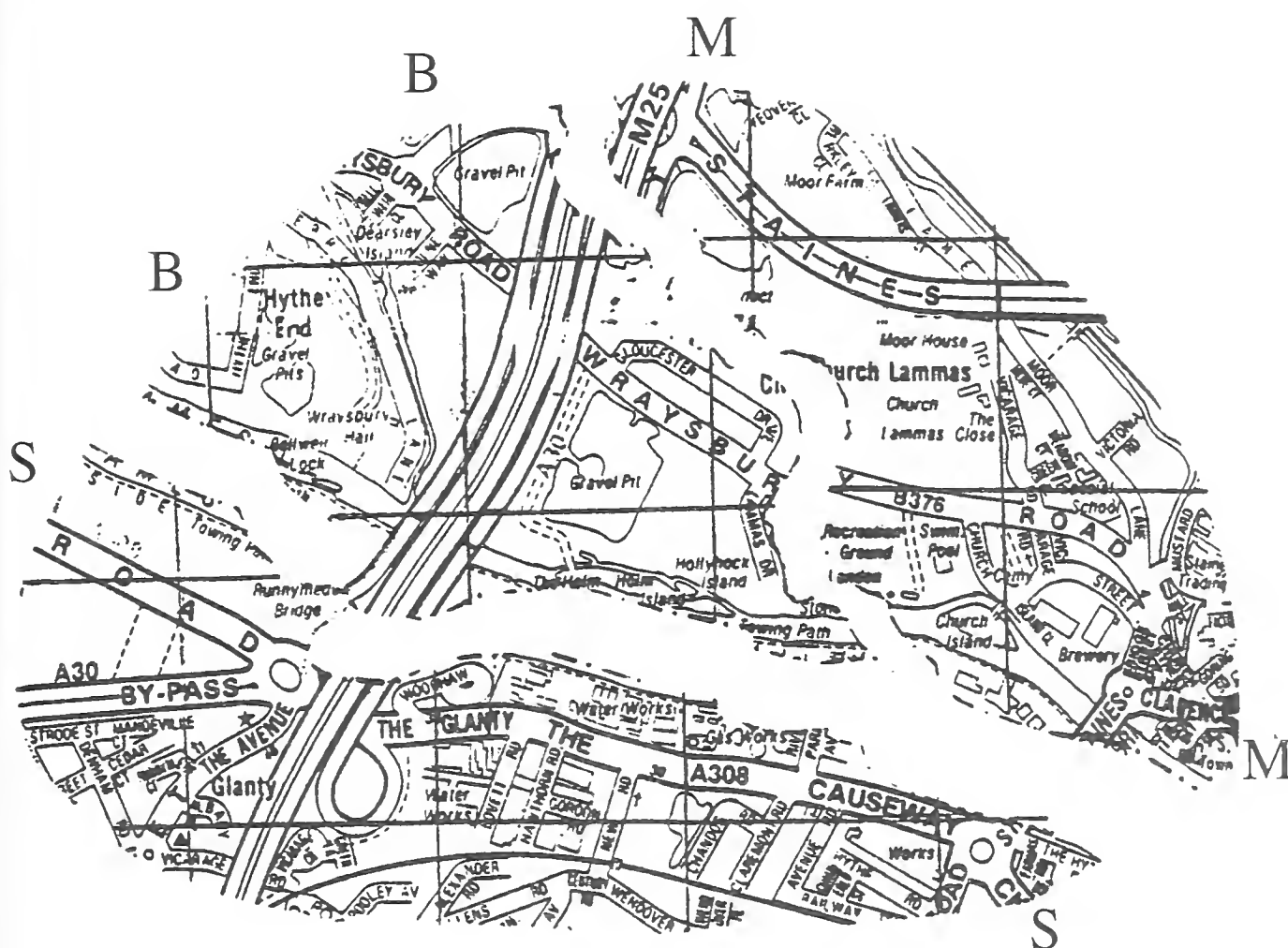


FIG. 11. Boundaries of Middlesex, Bucks. and Surrey west of Staines. Reproduced by permission of Geographers' A-Z Map Co. Ltd, from maps based on © crown copyright Ordnance Survey material.

end of the Middlesex–Surrey border, the beginnings of the Middlesex–Bucks. border (sect. 1) and the beginning of the Surrey–Bucks. border (sect. 6).

6. Surrey–Bucks.

This boundary is still the same as the modern county boundary between Egham in Surrey and Wraybury in Berks., and continues the line of the Thames upstream to the edge of our area at Magna Carta Island, except at the beginning where 200 m of right bank are in Bucks. and under the Runnymede Bridge of the M25 Motorway, where a rather larger area of land on the right bank is in Bucks. These discrepancies, which are shown in figure 11, probably result from former loops of the Thames before it was made navigable. In places like Abbeyfield mentioned in the previous paragraph, strongly angled bends can be assumed to be the result of old property boundaries becoming the basis for county allegiances.

7. Bucks.–Herts.

This line starts near West Hyde at 039900 and is the same as the modern county boundary to the edge of our area where it follows the River Chess. About half of its length is called Shire Lane, only a little over two kilometres of which at Horn Hill is a made road. The course of Shire Lane has been changed slightly where it crosses the M25 at 021915, but is otherwise unaltered.

8. Herts.–Essex

This boundary, like the last two, is wholly outside Greater London and has not been subject to changes in the century since Watson (1873). It continues the Middlesex–Essex boundary northwards and is very similar in character, following meanders of one arm or another of the River Lea from 375999 to 391091 at Glen Faba and of the River Stort from there to the edge of our area. This winding route is very different from that of the Lea and Stort Navigations. The six-kilometre length of

towpath from Waltham Abbey to Nazeing Marsh crosses the boundary three times. Where the boundary crosses Hunsdon Mead there may never have been a watercourse, as this is evidently ancient meadowland, with a group of *Orchis morio* which has been claimed by both counties.

9. Essex-Kent

The tideway of the Thames is the boundary between the London Boroughs of Newham, Barking and Havering and the modern county of Essex on one side and the London Boroughs of Lewisham, Greenwich and Bexley and the modern county of Kent on the other side, but the Watsonian county boundary differs in Newham, two areas of which totalling over two km² belong with Kent instead of Essex. The smaller of the two includes North Woolwich Station and the site where John Archer found a *Euphrasia* sp. in 1989 (Burton 1990: 141) and extends north into the King George V Dock basin. The larger runs along Gallions Reach and includes much of Beckton gas works and Beckton sewage treatment works. In the London County Council period, these areas were in the Borough of Woolwich. They are shown in Figure 12.

10. Kent-Surrey

Where this boundary starts from the Thames was the same as the point where the

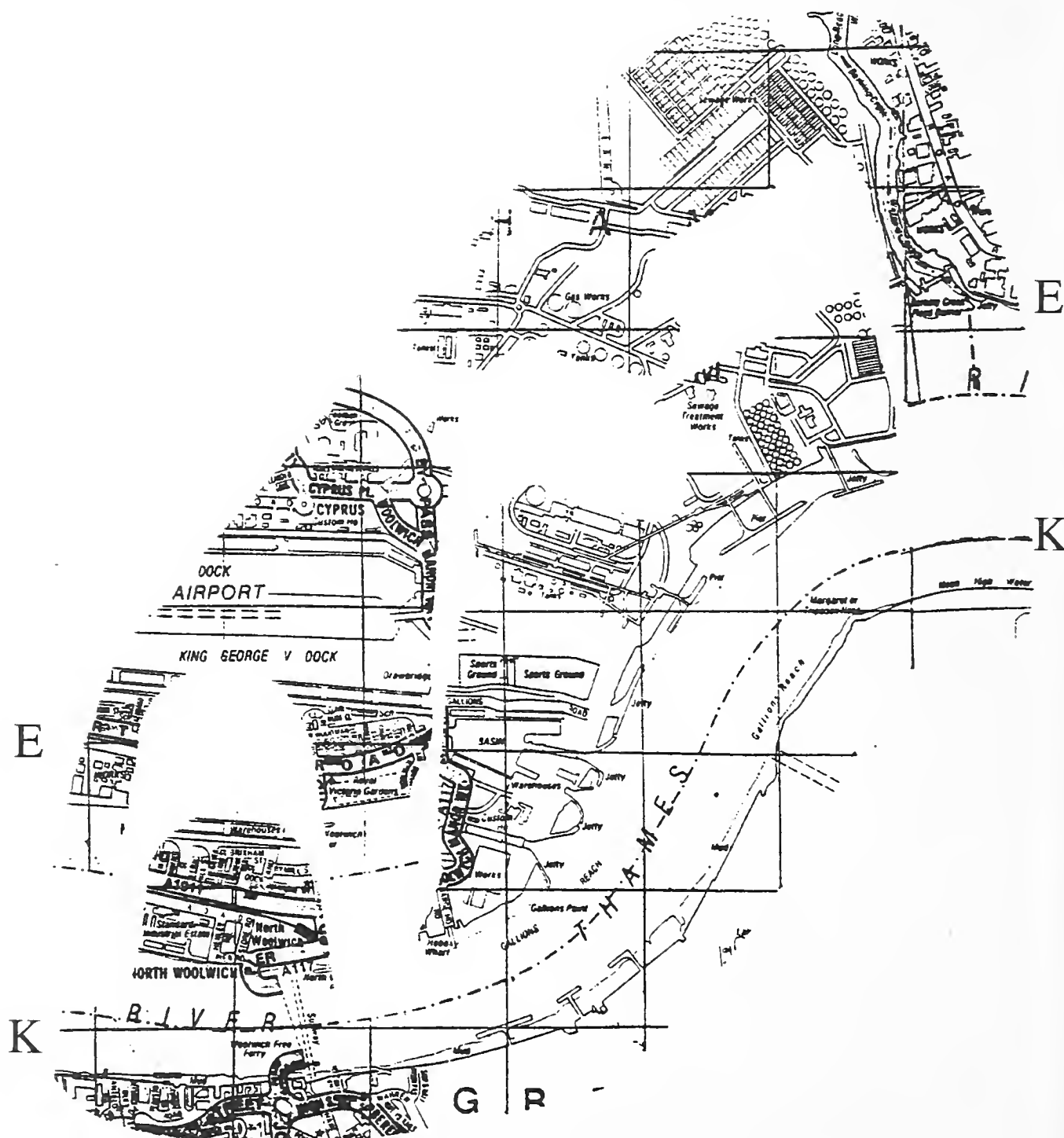


FIG. 12. Essex-Kent boundary about North Woolwich and Beckton. Reproduced by permission of Geographers' A-Z Map Co. Ltd, from maps based on © crown copyright Ordnance Survey material.

boundary between the London Boroughs of Lewisham (Kent) and Southwark (Surrey) started from the Thames, until the latter was moved slightly southwards by Report no. 637 of the Local Government Boundary Commission for England. From where the borough boundary meets Bromley at the north edge of Crystal Palace Park northwards for about two kilometres along the road called Sydenham Hill, it also coincides with the old county boundary. The long stretch of county boundary in between, shown in Figures 13 and 14, is very hard to relate to modern features on the ground. Senegal Fields, New Cross Gate (i.e. the turnpike between Kent and the end of the Old Kent Road?), much of Goldsmiths College and Telegraph Hill Park are in Lewisham but belong in Surrey. Most of Camberwell New Cemetery and the east slope of One Tree Hill are in Southwark but belong in Kent. The present boundary along the northern part of Sydenham Hill and the street called Wood Vale lies further west than the old county boundary, which passed along the east side of the Horniman Museum and to the top of One Tree Hill. The writer remembers having seen about thirty years ago a cast-iron county boundary marker by a street somewhere in the area between Brockley Station and Nunhead Cemetery, but cannot now find it. The present street pattern in that area dates, I believe, from a period soon after the establishment of the London County Council in 1888. The boundary ran along Ivydale Road, and the next street parallel to that to the west is called Surrey Road. Further north, the back gardens of Reservoir Road on the Kent side of the line are separated by it from the much longer back gardens of houses in Jerningham Road on the Surrey side.

From Crystal Palace Park southwards, most of the London Borough of Bromley is in Kent. Penge, Anerley and much of Crystal Palace Park which belong in Surrey are also in Bromley. The Kent–Surrey boundary can still be traced where it follows the course of the Pool River between Elmers End Road and Beckenham Road, behind the houses of Ravenscroft Road (Kent) and Ash Grove, Chesham Road and Royston Road (Surrey). Kent House is of course just in Kent. The present Bromley–Croydon borough boundary is rejoined by the vice-county boundary at 347688 near the bend in Cambridge Road. This section is shown in Figure 15. All of the London Borough of Croydon was in Surrey until 1 April 1994, when Report no. 615 of the Commission placed the whole of South Norwood Country Park in Croydon. It also put all of Royal Bethlem Hospital in Bromley, and made other minor changes to the borough boundary further south.

These changes apart, the county boundary is the same as the present boundary between Bromley and Croydon, Bromley and Surrey (with a few small changes introduced on 1 April 1994 by the Commission's Report no. 620) and finally Kent and Surrey as far as the edge of our area. For most of an eight-kilometre stretch it follows the line of a Roman road.

Acknowledgements

Ian Yarham of the London Ecology Unit went to a great deal of trouble to supply me with information about recent changes to London borough boundaries. I hope I can be forgiven for not citing fully the references to the publications of which he sent me photocopies of the covers. The photocopied maps reproduced here are taken from the *Master atlas of Greater London* edition 5C (1988), by kind permission of the Geographers' A–Z Map Company Ltd.

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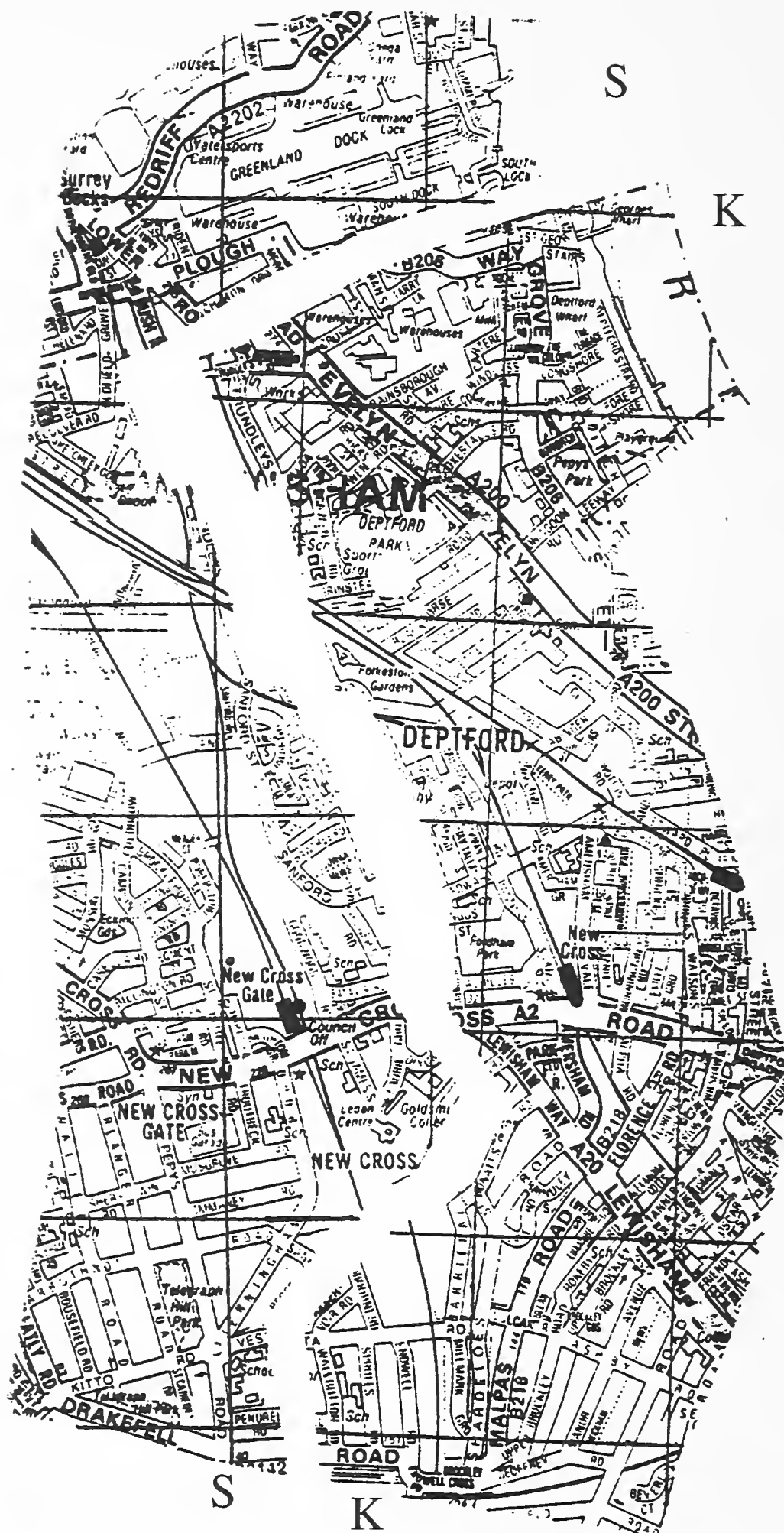


FIG. 13. Kent-Surrey boundary in the neighbourhood of Surrey Docks and New Cross. Reproduced by permission of Geographers' A-Z Map Co. Ltd, from maps based on © crown copyright Ordnance Survey material.

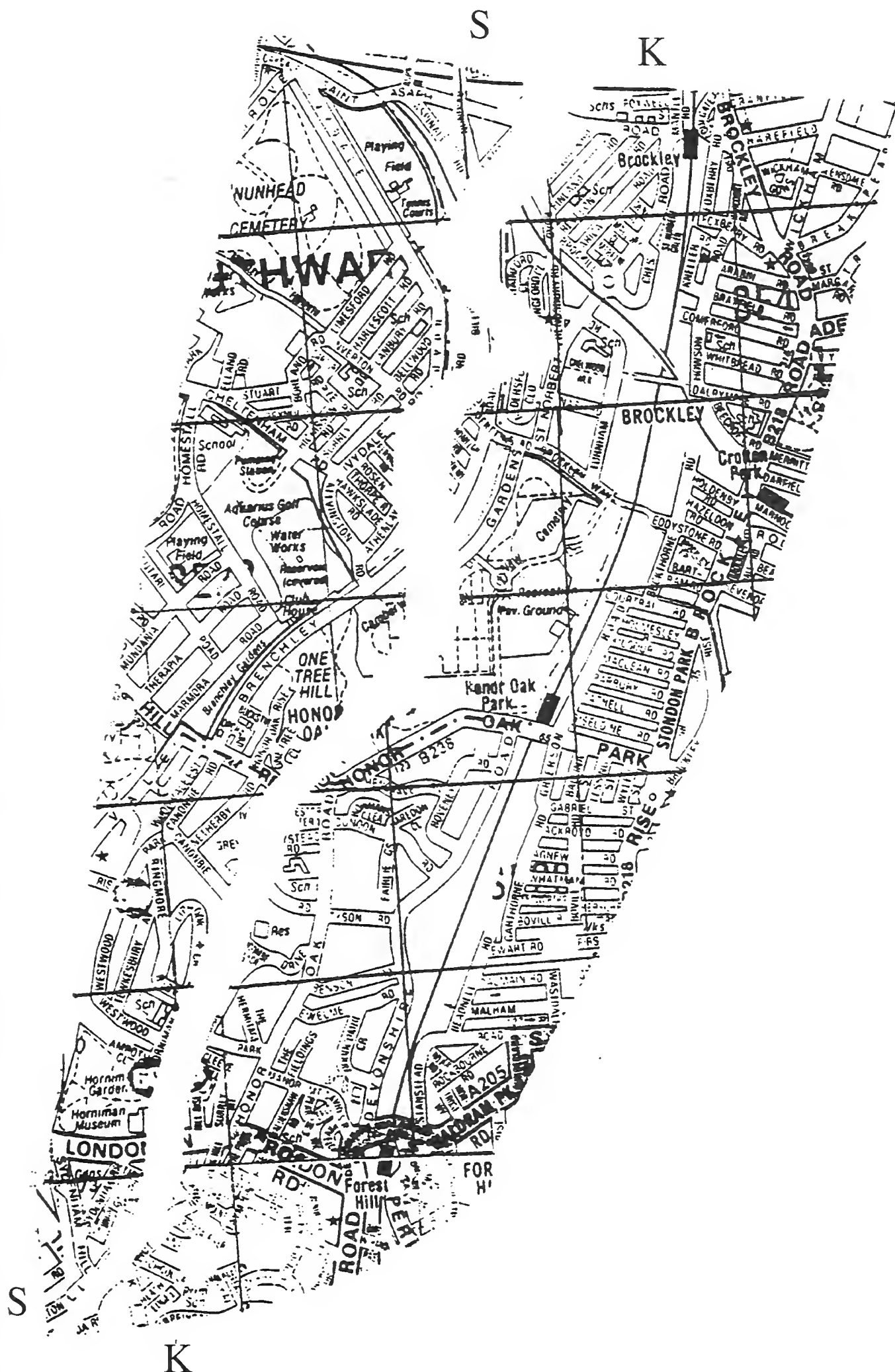


FIG. 14. Kent-Surrey boundary in the neighbourhood of Honor Oak. Reproduced by permission of Geographers' A-Z Map Co. Ltd, from maps based on © crown copyright Ordnance Survey material.



FIG. 15. Kent-Surrey boundary from Crystal Palace Park to South Norwood Country Park. Reproduced by permission of Geographers' A-Z Map Co. Ltd, from maps based on © crown copyright Ordnance Survey material.

A map of the surface geology of the London Area*

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Introduction

The influence of geology on the distribution of plants, and thus animals, is a widely known phenomenon yet one which is perhaps only shallowly understood by most naturalists. The influence of chalk is perhaps the most widely appreciated geological effect; the presence of free calcium carbonate in the soils overlying chalk rock prevents some plants from growing, but encourages others, and some excellent examples of this are given by Burton (1983). But relatively few field naturalists comprehend the subtleties of the many other rock types affecting our native flora and fauna. How, for example, can one explain the presence of chalk-loving plants in the clay soils of south-east Hertfordshire, or the presence of typically chalk-downland hoverflies on the predominantly sand and gravel beds of Blackheath?

Whilst preparing the maps and text for the work on London's larger moths (Plant 1993) a number of distribution anomalies soon became apparent and this left me in the difficult position of having to make a judgement of their validity. In cases where no specimen was available for examination, this judgement was all the more critical. However, some of these anomalies involved species with such strict requirements for either habitat or larval foodplant that it was clear that their overall distribution was affected by soil type — and hence geology — as much as anything else. Thus, a rough map of the surface geology was prepared and, to my surprise and delight, a number of these apparent anomalies were explained.

As a result of this discovery, it seemed logical to include a somewhat neater version of the geology map as an appendix to the moth book, but this was ultimately prohibited for reasons of finance. It was felt, however, that the map still had a useful purpose, whilst making the map available to a wider audience might be of help to naturalists other than lepidopterists in the London Area. This map is, therefore, included as a supplement to this volume of *The London Naturalist*. It shows the surface, or drift, geology of the entire LNHS recording area, as it is beneath the concrete and other man-made additions. In using it, readers should be aware of its limitations. Where a geological deposit is known to be less than one metre in thickness I have not mapped it. Nor have I mapped the many artificial importations of soil from other sites to places within the London Area. Many 'ecology parks' and the like will have imported soil and this may bear no relationship at all to the map, so that anomalies in distributions of plants and animals may still occur. A good example of this is given by Cribb (1993). Similarly, major road works, quarries and other works may affect the surface geology by the exposure of strata that were formerly hidden; even when these are again buried under imported materials, a degree of interface mixing may occur and this may affect the soil type that results.

Solid versus drift geology

Solid geology is the basic rock type which underlies the area. In our region this is essentially Upper and Middle Chalk capped with London Clay. A solid geology map of the London Area would show only the Cretaceous and Eocene rocks whilst the more recent materials would be omitted. Such a map is of very limited use in interpreting distributions of plants and animals. These patterns are largely influenced by soil type, and this is a function of the surface, or drift, geology.

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London's basic geology

The basis of the London Area is a shallow synclinal basin composed of Eocene and Cretaceous strata, laid down by the seas that covered the area between 40 and 140 million years ago, and folded into their present structure during the Miocene period about 15 million years ago. These strata surface as two ranges of chalk hills, both with outward-facing scarps — the Chiltern Hills in the north-west and the North Downs, running from the south-west to the east, through Surrey and Kent. These hills comprise almost all of the higher ground in the London Area, the highest point being between Woldingham and Limpsfield on the North Downs, at 269 metres above sea-level. Within the syncline are a number of minor upfolds and downfolds; one such minor upfold is responsible for the surfacing of the Chalk at Grays in Essex and at Charlton in Kent. The axis of the upfold is not horizontal, which is why the Tertiary outcrop is wider in the east than in the west. In places, the Chalk is overlain with later deposits of clay-with-flints, whilst beneath it, outcropping to the south of the North Downs, lie layers of Upper Greensand, Gault and Lower Greensand. Of these, the Lower Greensand reaches the surface as a line of hills along the southern margin of the London Area between Redhill in Surrey and Brasted Chart in Kent. Between these hills and the North Downs there is a narrow band of Upper Greensand and Gault, forming a low-lying clay vale. In the extreme south of the area, around the border of Kent with Surrey, there is also a small outcrop of Weald Clay.

Most of the floor of the London Basin between the North Downs and the Chiltern Hills is overlain with London Clay. The area is almost bisected by the River Thames, flowing from west to east. This is joined by the River Lea, flowing north to south just east of the mid-line of the area, and by the River Colne, flowing north to south about 5 km inside the western boundary, as well as by a number of lesser tributaries, such as the Roding and the Darent. All these rivers lie on wide beds of alluvium, bounded by brickearths and non-glacial sands and gravels, including river-terrace gravels, flood-plain gravels and Coombe deposits, overlying the London Clay particularly on the north bank of the Thames. Elsewhere, on higher ground, the clay basin is capped by Eocene deposits including the Bagshot Sands, for example at Epping Forest, Brentwood, Hampstead Heath, Harrow Hill, Horsenden Hill and Esher Common, or by Woolwich, Reading and Blackheath Beds and Thanet Sands, principally in the north-west corner of vice-county 16, West Kent. In the north-eastern sector on the Essex side of the River Lea, and extending patchily westwards across southern Hertfordshire, Boulder Clay overlies the London Clay.

The different rock types in the London Area

As this is not essentially a geological paper, it is not appropriate to embark upon a detailed account of the ages of the rocks and their formation. Little of this is of relevance in any case since in geological terms all of our native flora was formed extremely recently. Using the analogy of a 24-hour clock, if the earth formed at 00.00 hours and the present moment is 24.00 hours, even our most ancient of natural woodlands were not formed until a few milliseconds before midnight! It is what is here now that matters in the distributions of plants and animals.

This apart, a brief description of the eighteen rock types shown on the map may be of interest. These are presented in sequence, from oldest to youngest, and the numbers in parentheses after the names are those given on the key to the map itself.

CRETACEOUS MATERIAL

The Cretaceous period lasted from approximately 144 million to 66.4 million years BP, and Cretaceous rocks are the oldest in the London Area. They form what most of us would regard as 'real' rocks and are in fact part of the solid geology rather than the drift. Five basic types of Cretaceous rock outcrop in the London Area, principally in the south and south-east, but also in the north-west. They underlie the more recent Eocene

deposits, which were laid down by successive invading and retreating seas, and which are themselves overlain by more recent deposits.

Weald Clay (18) is our oldest rock type in London and represents the topmost bed of the Wealden series. Like all clays, the pH value is low, so that the soils which develop above the clays are acidic in character. The Weald Clay is non-marine in origin and, in the London Area, frequently contains quite thick bands of sandstone which allow for better drainage than the clay itself. Weald Clay is found in only one small part of the London Area, in the extreme south where the counties of Kent and Surrey meet.

Lower Greensand (17) overlies the Weald Clay. Various localized deposits have been given local names. The following are present in the London Area:

Folkestone Beds — sands, often heavily stained with iron. Bands of ironstone are frequently present and these inhibit drainage, so affecting the soil.

Sandgate Beds — sands. In areas such as Redhill and Nutfield, Surrey, they contain seams of fuller's earth, a non-plastic clay.

Hythe Beds — sandstone, usually with a slight greenish tinge. In places, the beds contain a good deal of chert, a flint-like substance which increases the resistance of the outcrop and gives rise to hills.

Atherfield Beds — clay of a marine origin.

The Lower Greensand has a low pH value giving rise to acidic soils. The Sandgate and Hythe Beds provide well-drained soils as a result of the porous nature of sand and sandstone; Folkestone Beds provide less-well-drained soils because of the impervious bands of ironstone; Atherfield Beds are typically poorly-drained clay. Lower Greensand forms a band of low hills across the south of the London Area, between Redhill in Surrey and Brasted Chart in Kent, but is otherwise absent from the map.

Gault (16) is another clay, rather more consolidated than London Clay and greyish in colour. It is acidic in nature and so, therefore, are associated soils. Unlike sandstones, clays retain water very efficiently, and so damper habitats are permitted to develop. Gault outcrops in the London Area as a narrow band between the Upper and Lower Greensand. Together with the Upper Greensand, it forms a valley (the Vale of Holmesdale) between the Lower Greensand hills to the south and the North Downs to the north.

Upper Greensand (15) is more recent than the Lower Greensand. It is essentially a pale, greenish sandstone but it differs from the Lower Greensand in that it is calcareous in places as a result of interface mixing with the more recent Chalk, above. It outcrops in the London Area as a very narrow band between the Chalk and the Gault, becoming progressively narrower eastwards and ultimately vanishing altogether, before it reaches our boundary, just beyond Westerham.

Chalk (14) is probably the best known of the 'real' rocks in the London Area. It was formed principally from coccoliths produced by calcareous algae, together with the shells and exoskeletons of various marine invertebrates that fell to the sea bed when they died some 140 million years ago, and later (around 15 million years ago) folded upwards by movements of the earth. It extends in a broad band from south-west to east forming the North Downs and outcropping north of the Thames in Essex at Grays Thurrock. Very little Essex Chalk remains because of extensive quarrying activity, but there were once Chalk cliffs at Purfleet. The Chalk also outcrops in the north-west where it forms the extreme outlying edge of the Chiltern Hills. Notice also very small outcrops of Chalk just south of the Isle of Dogs and in a line running east of here. It is important to realize that all of these outcrops are in fact connected below the more recent deposits, though they are at some considerable depth below the ground surface. Chalk is extremely alkaline (high pH value) and very soft. As a result it is easily eroded and broken by rain, rivers, frost action and other factors. The overlying soils are usually thin and are always alkaline in character.

There are three divisions of the Chalk, identified on the presence or absence of flints and the types of fossils present. The Lower Chalk is the oldest; it is a grey chalk without any flints. Middle Chalk is a white chalk without flints, whilst the most recent deposit, the Upper Chalk, is white chalk with flints present. Both Middle and Upper Chalk are represented in the London Area, but since there is no discernible difference between the two as far as effects on flora and fauna are concerned I have not separated them on the map. Lower Chalk is only represented in our area at artificial exposures, such as the quarries at Merton, Betchworth and Oxted.

EOCENE MATERIAL

The Eocene period is a division of the Tertiary era which extended from approximately 66.4 million to 1.6 million years BP. Preceded by the Palaeocene and succeeded by the Oligocene, the Eocene itself lasted from between 57.8 million and 36.6 million years ago. It was a very active period in the evolution of the planet; the name itself is taken from the Greek *ēōs*, meaning the dawn — the Eocene being regarded as the dawn of Recent life. Immediately following the Oligocene was the Miocene; this was the period during which the earth's surface rocks were folded and convoluted; the London Basin is one of the great downfolds with the Chalk forming the hills to the north and south with the softer Eocene deposits between them.

Thanet Sand (13) is the oldest of London's Eocene rocks. It is a typical sand, reddish in colour, very porous and with a low pH giving rise to acidic conditions. It typically overlies Chalk and in the London Area is to be found as a thin band along the northern edge of the North Downs as well as patchily on the top of the downland Chalk, becoming more frequent in Kent and across the River Thames in the Grays Thurrock area of vice-county 18, South Essex.

Woolwich and Reading Beds (12) are next in the chronological sequence. The Reading Beds extends westwards from the London Area and are essentially mottled clays with sand. Good examples are available at Ashted. Associated soils are acidic in character. The Woolwich Beds lie in the east of our area (and extend eastwards into Kent) and are a very variable series of clays, loams, sands and shell beds. In some areas the shell dominates, rendering the soils above calcareous. In other areas, the beds are almost entirely sands, a good example being the entomologically-famous Charlton Sand-pit, which is now a geological SSSI. Woolwich and Reading Beds can be seen in the London Area along the edge of the London Clay in the north-west and between the London Clay and the North Downs in the south, extending patchily westwards in south London and eastwards in Kent.

Blackheath Beds (11) are the next oldest of London's rocks and overlie the Woolwich and Reading Beds. They are unconsolidated sand and gravel beds; they are especially obvious at Keston Common, where the pebbles are black. In places marine shell deposits are present. The best examples of these are further east in Kent, but in the London Area we have a good example at Abbey Wood, where numerous past discoveries of sharks' teeth provide proof of the marine origin of the beds. Blackheath Beds form an extensive patch in south-east London and occur patchily atop the downland Chalk but are otherwise absent from the London Area.

London Clay (10) is probably a term known to almost everyone in the London Area. This sea-bed deposit extends as a broad belt from west of London north-eastwards to the Essex/Suffolk coastline and also occurs in the Hampshire Basin, including the northern half of the Isle of Wight. It is a blue, homogeneous clay, but quickly becomes brown on exposure to the air. It covers much of the floor of the London Basin and is overlaid in many areas by the more recent deposits in this chronological sequence. It is highly acidic and totally impervious to water. Rain falling on the North Downs and the Chiltern Hills soaks through the Chalk (which forms a layer under the entire London Area) and becomes trapped. If a borehole is sunk through the London Clay in the centre of London, down into the Chalk, the water escapes upwards under pressure and will

rise to the height equivalent of the surface of the water table in the surrounding hills, thus creating a 'natural' fountain; this is what is known as an artesian well, and as every schoolboy used to know, the fountains in Trafalgar Square formerly operated on this principle. Today, the water-table is so low that artesian wells cannot now be created in London.

Claygate Beds (9) are sandy beds with a high proportion of clay in some areas as a result of mixing with the London Clay upon which they rest. Indeed, some authorities regard them as an upper layer of the London Clay and include them with that deposit on maps. However, the two differ in their influence on soil drainage and so, for the purpose of trying to comprehend biological distributions, I have retained them as separate beds on the present map.

Bagshot Beds (8) are essentially unconsolidated, fine, white to buff-coloured sands with seams of pipe-clay. They always rest on top of the Claygate Beds in the London Area and these two deposits, together, rest atop the London Clay forming small hills or ridges. They are responsible for Harrow Hill, Hampstead Heath, the Epping Forest ridge and the complex of woodlands around Weald and Thorndon Parks in Essex amongst other sites north of the Thames, whilst south of the river they are only to be found in the extreme south-west of the London Area, at Esher. Their high permeability and low pH allow for the evolution of acid heathlands.

Barton and Bracklesham Beds (7) are very close in age, the Bracklesham Beds being just slightly older. They are represented in the London Area only by a small deposit in the extreme south-west. Here, they comprise fine-grained sand, with clay and occasional loamy seams.

PLEISTOCENE MATERIAL

The Pleistocene period represents the first half of the Quaternary era, giving way to the Recent, or Holocene, period. The Pleistocene lasted from approximately 1.6 million to ten thousand years ago and was an age of successive glacial and interglacial cycles. During the glacial periods, something in the order of 30 per cent of the earth's surface was covered in ice, comparing with around 10 per cent today.

Clay-with-flints (6) is a fairly descriptive name for the oldest of the Pleistocene formations in the London Area. In some areas the flints are replaced by pebbles or even sand. These flints and other materials are essentially the insoluble remnants of Tertiary beds which were, as a whole, dissolved by water and ice. As the ice melted, so the hard material was deposited with the finer clay. Some reworked Tertiary material is also present. Patches of clay-with-flints are to be found along the length of the North Downs and on the Chiltern Chalk in the extreme north-west.

Glacial Gravels (5) are what the name suggests, various gravels that have been brought into the area frozen within the ice-sheet that just reached the northern part of the London Area and deposited as the ice melted. They dominate the surface geology in the north and north-west of the London Area, but are also present in Epping Forest, Essex.

Boulder Clay (4) differs in the London Area from the clay-with-flints in that the boulders are of wide variety. In many places in our area they are almost exclusively chalk, though elsewhere they comprise sandstone, pebbles or even igneous rocks (probably of Scandinavian origin). Some of the boulders are really quite large. Even fossils such as belemnites and *Gryphaea* can be present, derived from Jurassic rocks beyond the Chilterns. This glacial clay deposit spreads into the north of the London Area across the Hertfordshire Plateau and is the dominant rock type in the north-east. However, it is not found south of Finchley, and even there it is reduced to a narrow tongue which has come down. The effect on the associated soils is quite interesting. In many areas the acidic clay exerts its influence, but wherever the ground is disturbed, chalk nodules surface and localized patches of alkalinity occur, having a profound effect on the flora and fauna.

RECENT MATERIAL

The Recent, or Holocene, period began some 10,000 years ago and is continuing today. All Recent deposits in the London Area are riverine.

Our three London Area deposits from this period, **alluvium** (1), **brickearths** (2) and the various **non-glacial gravels** (3), are all what may be termed alluvial deposits, that is they were deposited by river action over the years. As the river erodes its way through the ground, gradually achieving a lower level, the various deposits form terraces. Alluvium is the most recently deposited terrace and it is still being deposited today. Next oldest come the brickearths and then the various gravels which themselves form different terraces. It is these gravels that have been the subject of open-cast quarrying in the Thames region in recent years. The various different gravel terraces have all been named, though for the purpose of the present paper this is an unnecessary detail. Those wishing to read more on the subject are referred to, for example, Davies (1939). The gravels and brickearth tend to be acidic and well drained in character and a number of London's acid grasslands are situated in these areas. The alluvium itself is very varied in character, often having a high silt content. In eastern London, at least, it is only a few metres in depth, and overlies a layer of peat that was formed around 3,000 years ago. Of particular interest in the London Area is the ease with which these deposits give away the locations of former streams and rivers that once flowed into the Thames; the line of The Fleet, for example, is clearly visible on the map.

Acknowledgements

Like most things, this geology map is the result of the efforts of more than one person. Ken Hill redrew the outlines of the various rock types from my battered, much-folded hand-coloured rough working map, using an extra large drawing board very kindly loaned (and delivered to his living-room) by Havering Borough Council's Planning Department. This may sound an insignificant task, but if anyone saw the state of my original, and knew that the thing was nearly one metre square, they would then realize the enormity of the task that Ken so admirably performed.

Proofs of the map were seen by Tony Barrett, Ruth Day and Mike Earp, all of whom made very helpful comments on presentation and other matters of a largely non-geological nature, and by Richard Butler, a former teacher of geology and a vice-president and former president of the London Natural History Society, who was able to make a number of suggestions concerning geological correctness. It is only fair to him to report that I did not include all of his alterations, most notably, his recommendation that the Claygate Beds and the London Clay should, correctly, be combined as a single colour; these I retained as separate colours on the basis that they are sufficiently different in character to have an effect on the flora and fauna. I also retain the boundary of the Lower Greensand for similar reasons. It follows, therefore, that any errors in the map are the fault of myself and not of Richard.

Mr Butler, and also Fiona Talbott, Assistant Keeper at the Cuming Museum, London Borough of Southwark, also read and commented upon the text of this short paper as well as providing advice and information on the nature of the various geological deposits, all of which I have included in the descriptions above.

Finally, I must express gratitude on behalf of the London Natural History Society to the Copyright Manager of the British Geological Survey for permission to reproduce data from the Geological Survey of Great Britain (England and Wales) map sheets which are indicated on the present map and for permission to publish this map of London's surface geology.

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Obituary



CHARLES BRADWIN ASHBY, 1920–1994

The sudden death of Brad Ashby on 9 January 1994 deeply shocked us all and no tribute can sufficiently describe the high esteem in which he was held by fellow members of the London Natural History Society. Brad joined the LNHS in 1939, at which time he was especially interested in ornithology, and this, with entomology, and later ecology, he pursued throughout his life.

Brad Ashby was born on the 13 June 1920 and lived his early years with his parents in Chelsea. His father had a shop in the Kings Road in which, as G. Ashby & Sons Ltd, he carried on an electrical business. When Brad was ten years old his parents moved to Carshalton, Surrey, his father travelling up to London each day. The following year, having reached secondary school age, Brad entered Sutton County (now Grammar) School for Boys where he remained for the next five years. One of us (EWG) was at the same school, though in the form lower, and remembers Brad, not as a member of the school natural history society as he, but as a keen participant of the art club. When Brad left in 1937 he joined his father's business, continuing his studies in the evenings in order to obtain the Diploma of the Institute of Electrical Engineers. He took the final exams for this just as World War II was declared.

When the time came for Brad to be called up for military service he was, because of his electrical qualifications, drafted into the Ministry of Aircraft Production, at their headquarters in Millbank, London. During the next five years he had the task of

assessing what electrical faults, if any, might have contributed to the grounding of aircraft.

Shortly after the end of the war he was released from service with the Ministry and rejoined his father's business in Chelsea. When his father died in 1955 he took over, first as manager then later as director of the company. He had thought of relinquishing this position when he reached sixty-five in 1985, but as the business had been founded in 1888 by his grandfather, Brad decided to continue, to celebrate the firm's centenary in 1988 before retiring.

In 1944 Brad joined the Society's Ornithological Records Committee; in 1946 he became Recorder for the South; in 1948, chairman, and at the same time, editor of the *London Bird Report* for four years. He remained on the editorial committee until 1960. He was a co-organizer of the Society's great crested grebe survey, and also Surrey area organizer of our rookery census. In *LBR* 12 (1948) he contributed a paper on the effects of the early 1947 freeze-up on London's birds. From 1945 till 1947 he served on Council and during this period of renewed immediate postwar activity, he contributed to a number of Society lectures on aspects of field identification involving such groups as birds of prey and gulls.

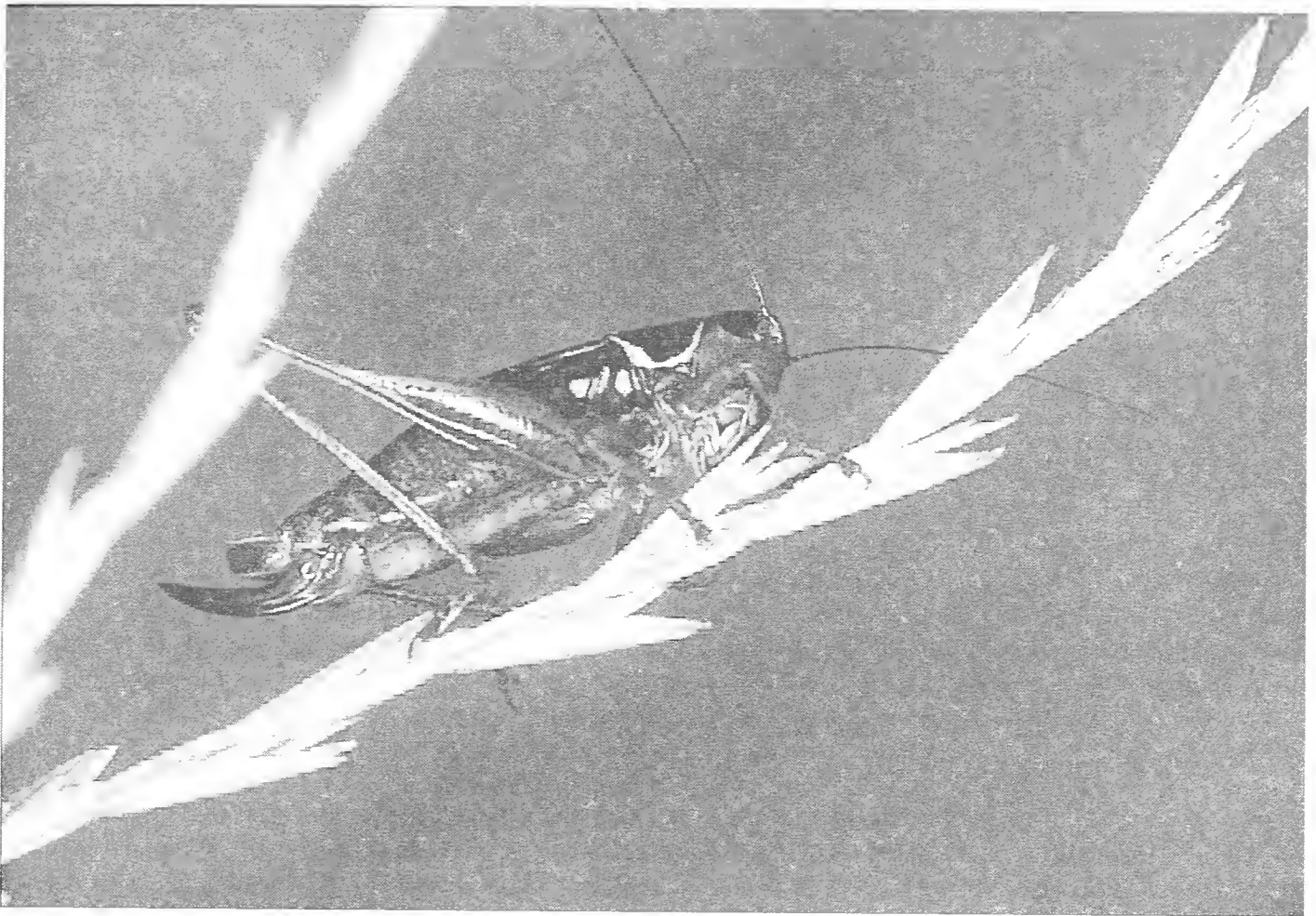
Brad was a valuable member of the committee, chaired by R. C. Homes, that in 1957 produced the Society's first book *The birds of the London Area since 1900*, writing the chapter on 'The river valleys and sewage farms', assisting with the systematic list, and providing sixteen of the habitat photographs. He was also an active member of the Society's small, but flourishing, bird-ringing team.

Following publication of the 1957 book, Brad turned his attention more towards ecology and entomology, and for a number of years devoted much of his time to photographing insects, especially moths, in colour. Many of these photographs were used to good effect at indoor meetings of the Ecology and Entomology Section. However, we must not forget that Brad had earlier been a successful hide photographer, and some of his black-and-white plate photographs of birds, taken in Scandinavia and



Moorhen

Photo: C. B. Ashby



Roesel's bush-cricket.

Photo: C. B. Ashby

the Camargue, are fine portraits. A lapwing photographed at Beddington Sewage Farm is particularly good.

In the 1960s Brad began light-trapping for moths at Bookham Common, contributing to the annual Progress Reports in *The London Naturalist*. He also became a member of the Entomology Section's committee during the sixties, and in 1984 became secretary of the by now combined Ecology and Entomology Section, a post that he held with enthusiasm until his death. Brad had always been a strong advocate of the importance of the Society's activities being recorded in print for posterity, and in March 1984 he began a series of transcriptions of lectures given to the Ecology and Entomology Section. These proved highly successful and continued until September 1986, to be superseded in January 1987 by an even better endeavour, *The London Atalanta*, a 'modest' (one of Brad's favourite words), but simple and attractive product of his own initiative, and named after one of our most popular butterflies, the red admiral. It comprised just four pages on a single sheet of folded A3 paper, and was fully supported by the Section's committee. Initially it was produced six times a year, but after two years this was reduced to four, and it was available to those attending the Section's meetings and Bookham Common. Later Council agreed to circulate it to all members, slotting it in with the regular Society two-monthly mailings. In September 1985 he inaugurated the annual series of joint indoor meetings with our sister society, the British Entomological and Natural History Society. These have proved very successful, with each providing alternately the speaker and the venue.

During the 1980s, Brad turned his attention to limnology, no doubt prompted in part by his long-standing membership of The Quekett Microscopical Club, and also by the fact that the attention of this discipline in earlier Bookham reports had been rather scant. His first contribution appeared in 1990. When, sadly for all of us, Brad's lifelong friend, and chairman of the Bookham Common Survey Team, Geoffrey Beven, died in March 1990, Brad immediately took his place. Apart from his perennial ornithological and entomological interests, he encouraged the visitors to Bookham to explore the ponds, and this has already led to them being revitalized and their faunas and floras

examined in more detail, not only by members, but by visiting microscopists from The Quekett and elsewhere. One result of this is the ongoing production, with specialist help, of a colour video recording of the microscopic aquatic life. Brad was instrumental in improving facilities at our Bookham hut, resulting in some tasteful refurbishment.

Brad Ashby was president of the LNHS for 1989 and 1990, a position which pleased him immensely and which he carried out with enthusiasm, earning the respect of us all in his loyalty to the Society and his deep interest in all our activities. He was especially pleased when Council appointed him an honorary vice-president on 25 November 1991.

However, Brad's interests extended beyond the LNHS. The Quekett Microscopical Club and the British Entomological and Natural History Society were the better for his involvement. Both traditionally contained LNHS members, but the latter was our sister society, being founded in 1872 as the South London Entomological and Natural History Society, whilst we were mainly involved north of the Thames, and one of our roots was the North London Natural History Society. Many of our entomological members have been deeply involved in both societies, and indeed, Brad had, since 1987, been a trustee of the BENHS. In recent years he had been engaged at home in rearranging their large Torstenius collection of Scandinavian Lepidoptera — an arduous but rewarding task. He was also instrumental in securing for the BENHS a new permanent home at Dinton Pastures Country Park, near Reading.

Recently, Brad had been a member of our newly-formed Publications Working Group whose first production was Colin Plant's *Larger moths of the London Area*. On its front cover is his photograph of an elephant hawk-moth. It is true to say that whatever activity he engaged in, he fulfilled it with the utmost thoroughness.

Brad always had an interest in classical music and was a keen visitor to the ballet at Covent Garden and The Proms at the Royal Albert Hall. But it was perhaps his love of opera that gave him the most pleasure, especially in later years. Gardening and botany were also favourite pastimes, and many of his holidays in Sweden enabled him to pursue his interest in wild orchids.

Brad Ashby was a family man. In 1945 he married Hilda Knapp and they had two daughters; the younger, Catherine, lives with her husband in Sweden, and this is where most years Brad and Hilda have spent long birdwatching holidays. His elder daughter, Melanie, lives with her husband and their two children in Sussex. To Hilda, her daughters and their families we extend our deepest respect. We share in their sad loss.

KEITH H. HYATT and ERIC W. GROVES

Index to *The London Naturalist* 52–72, 1973–1993

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Introduction

This index continues those of Fitter (1953) and Burton and Hillman (1973). The format follows that of the earlier works, except that in the subject index, reference is by issue number rather than by year of publication. Some new categories have been added to the subject index.

Throughout the index, London Area refers to the London Natural History Society's recording area, as opposed to the London area in a general sense.

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"AVEBURY WORLD HERITAGE SITE AND ITS MANAGEMENT"
FRIDAY 30TH SEPTEMBER 1994

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Book review

Nature conservation in community forests. Sally Marsh. London Ecology Unit. Ecology Handbook No. 23. 1993. 64pp. Price not stated. Available from bookshops or direct from the LEU, Bedford House, 125 Camden High Street, London NW1 7JR. Tel. 0171-267 7944. Fax 0171-267 9334. ISBN 1 871045 20 7.

This book begins: 'The initiative "Forests for the Community" was launched on 25 July 1989 as a joint venture between the Countryside Commission and the Forestry Commission. It is a national programme targeted at the urban fringe with the long term aim of improving the environment around our towns and cities and providing new jobs in forestry, nature conservation and leisure.'

As soon as you read that those three different job opportunities are to co-exist in the same forest, you can see the necessity for strategic guidelines and careful planning. The London Ecology Unit are experts at urban and suburban nature conservation. They were set up in 1983 by the late-lamented GLC and pioneered modern techniques of site-based nature conservation within the planning system and for the benefit of local people. They are therefore uniquely qualified to provide these guidelines and this is what Marsh's book does — and to my mind, does extremely well.

Two of the initial twelve Community Forests come within the London Natural History Society's 20-mile recording circle: Thames Chase, perilously poised in the East Thames Corridor between Brentwood and South Ockenden, and Watling Chase, between Stanmore and Hatfield, to the north of London. The M25 goes through the middle of both of them. These 'forests' were never intended to be solid blocks of trees. Apart from roads and buildings, they are supposed to contain areas of grassland and marsh, wet flushes, pastures bordered by hedgerows and green lanes to link the separate components so that a family can enjoy a Sunday walk in natural surroundings and animals can move from one area to another. Marsh takes Thames Chase as an illustrative example and sets out a four-part strategy. Part A describes how best to ensure that *existing* and potential nature conservation interest of both woodland and non-woodland habitats are fully examined. Part B sets out ecological guidelines for establishing new woodland. Part C explores possible community initiatives in nature conservation and Part D discusses the benefits of a revived forest culture. There are also good references, a directory of relevant organizations and a guide to the grants available at the time of publication for habitat creation and management.

RUTH DAY

Microlepidoptera of Middlesex — an appeal for records

COLIN W. PLANT

RECORDER FOR LEPIDOPTERA

Following on from the success of the recent publication of *Larger moths of the London Area*, the London Natural History Society now proposes to work towards publication of a check-list of the Microlepidoptera of Middlesex. It is expected that this exercise may take about five years to complete.

The term Middlesex involves the entire vice-county 21 and thus includes all the London boroughs north of the River Thames with the exception of the five lying east of the River Lea; these five are in vice-county 18, South Essex. Middlesex also incorporates some areas which lie in the current administrative country of Hertfordshire, notably the Potters Bar area. Records are actively sought from appropriate persons for all those families generally regarded as 'micros' — thus including the Psychidae which were formerly referred to the 'macros', as well as those which are sometimes referred to as 'Mesolepidoptera' — the Tortricidae, Alucitidae, Pyralidae and Pterophoridae.

Records should include the species name, the Bradley and Fletcher Code number (to avoid nomenclatural confusion), the date where possible, and the locality. Records will be assumed to relate to imagines unless 'mine', 'larva', or other qualifying statements are given alongside. Localities will ideally involve a place name and a four-figure grid reference. Place names should be those appearing on the Ordnance Survey maps; precise localities, such as the names of nature areas or ecology parks in London are desirable, but if these do not appear on OS maps the nearest locality should always be given. Where a grid reference cannot be obtained, a precise address as it appears in one of the various published books of street maps of London should be used. Site lists will ideally be presented in log-book order to facilitate data entry. Overnight trap dates should be given according to the example 23/24 August or 23 August, and not as 24 August. Approximate counts and sexes are desirable for immigrants. Confidentiality of selected records may be requested. Records are required from all time, not just the present.

Records should be addressed to the London Natural History Society's Lepidoptera Recorder, Colin W. Plant, 14 West Road, Bishop's Stortford, Hertfordshire CM23 3QP, who will happily provide more detailed information. All communications will be acknowledged and records from outside Middlesex contained in mixed lists will always be forwarded to appropriate recorders unless directions are given to the contrary.

Book review

Quaternary of the Thames. D. R. Bridgland. Joint Nature Conservation Committee. Chapman and Hall, London. 1994. 441 pp. £79. ISBN 0 412 48830 2.

This is the latest volume in the Geological Conservation Review series. It is the seventh in the series and the third to deal with the Quaternary. There are five major chapters: the first covers the Pleistocene of the Thames, the second deals with the Upper Thames Basin, the third deals with the Middle Thames, the fourth covers the Lower Thames, and there is a final chapter on Essex. The sites described relate to the history of the Thames during the Quaternary, its preglacial course through East Anglia, its diversion by ice advancing from the north, and its final evolution into its present-day course. The correlation of the terrace deposits is dealt with in great detail and archaeological evidence is included.

Whilst the section dealing with the Upper Thames contains no site within the LNHS area, any student of London's geology must take full account of it in order to appreciate fully the sites further downstream. The Middle Thames section brings us up to date on recent thinking concerning such deposits as the Pebble Gravel, and discusses deposits connected with the Thames in the Vale of St Albans. The section on the Lower Thames contains several sites within the Society's area such as the Hornchurch railway cutting and Wansunt pit on Dartford Heath. Twenty-four pages are devoted to Swanscombe, the first National Nature Reserve declared for geological reasons. Swanscombe is the site which has yielded human fossil remains along with bones of other animals. The archaeological evidence here is also very important and has not been ignored. The area around Purfleet and Grays is dealt with in great depth whilst Aveley is also described in detail. It was at Aveley that remains of elephants were discovered in 1964. The final section takes one deep into Essex, to the coast in fact at such places as Clacton and Holland-on-Sea, eventually dealing with deposits of local rivers. The isotopic variations for oxygen during the Pleistocene figure prominently in the discussions and have led to a number of revisions in the correlation between the deposits.

The book does not claim to be a field excursion guide. In fact it would probably be an encumbrance in the field. However anyone wishing to visit any of the thirty-eight sites described is well advised to make a detailed study of any chosen site or sites before embarking on the necessary journey. Such studies will be well worth while.

R. E. BUTLER

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The London Naturalist

Instructions to contributors

Submission of papers

Papers should be submitted **in duplicate** to the editor, Mr K. H. Hyatt, at his home address, or c/o Department of Zoology, The Natural History Museum, Cromwell Road, London SW7 5BD, before the end of January if they are to be considered for publication in the same year. However, the editor will be pleased to be contacted at any time to discuss possible contributions. Manuscripts should be typed on one side of the paper only and with double spacing and wide (3-cm) margins. Authors must retain a copy. Papers should include at the beginning an **abstract, summary or synopsis. Sheets must be numbered.** The editor would be pleased to receive contributions as ASCII files on disc (either 3½" or 5¼") in IBM-compatible format as well as in manuscript as above. Papers should be relevant to the natural history and archaeology of the London Area. This includes comparisons between London and its surrounding countryside with other localities, as well as work relating to species or habitats which occur in the London Area.

Text

Locality spellings should follow the latest editions of the maps published by the Ordnance Survey. Capitalization should be kept to a minimum. Common names of animals and plants must begin with lower-case initials, and **only** Latin names of genera and species must be underlined. When both common and Latin names are given there should be no brackets or commas separating them. **Genus names should appear in full where first used within each paragraph.** When scientific names are taken from a standard work, which must be cited, authorities should be omitted. In descriptive matter numbers under 100 should be in words, except in a strictly numerical context. Dates in the text should follow the logical sequence of day, month, year, i.e. 25 December 1971, but in lists as 25.xii.1971. Measurements should be in metric and follow the SI system (Système International d'Unités), with imperial equivalents in parentheses where appropriate. There should be no full point following Dr, Mr, Mrs or St. Lists should be in systematic, alphabetical or numerical order. **Hyphens should not appear at the ends of lines. Tables should be typed on separate sheets at the end of the text. Word-processed text should not use italic, bold or compressed typeface. Paragraphs should be indented.**

References

Reference citation should be based on the Madison rules (in *Bull. Torrey bot. Club* **22**: 130–132 (1895)), except that a colon should always precede a page number. Capitalization in titles of books and papers in journals should be kept to a minimum. Journal titles should follow the abbreviations in the *World list of scientific periodicals* and be underlined. Book titles should also be underlined. Examples are as follows:

In text:

Meadows (1970 : 80) or (Meadows 1970).

In references:

MEADOWS, B. S. 1970. Observations on the return of fishes to a polluted tributary of the River Thames 1964–9. *Lond. Nat.* **49**: 76–81.

MELLANBY, K. 1970. *Pesticides and pollution*. Ed. 2. Collins, London.

WHITE, K. G. 1959. Dimsdale Hall moat, part II. *Trans. a. Rep. N. Staffs. Fld Club* **92**: 39–45.

Authors must ensure that all references are cited accurately: they will not be checked by the editor.

Illustrations

Distribution maps should be submitted in the form of a recording map with symbols in Indian ink and stencilled or by transfers, e.g. 'Letraset'. Solid dots are used to indicate contemporary or recent presence, circles for old records and crosses (not pluses) for other information, such as introduced species. The caption should be written outside the frame of the map and will be set up by the printer.

Line drawings should be in Indian ink on white card or tracing paper, larger than the printed size, but no larger than A4. Place names, etc., must be produced with stencils or Letraset. Captions should be separate as they will be set up by the printer, but keys that include special characters should be included within the borders of the figure.

Photographs should be glossy black and-white prints, of good contrast, preferably plate or half-plate in size, or, following consultation with the editor, in the form of colour transparencies, either 35 mm or larger. Colour prints are also suitable for reproduction in the text in black and white.

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